Ambix

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OBITUARY

ERIC JOHN HOLMYARD (1891–1959)

Dr. Eric John Holmyard, the Society's Chairman since 1 October, 1947, died on Tuesday, 13 October, 1959, at the age of sixty-eight at his home in Clevedon, Somerset. By his labours among us as our Chairman and by his ability to inspire the affection and loyalty of his colleagues, he had brought our Society to the most flourishing state in its history and had seen it at last soundly and firmly established after many difficulties.

Holmyard was a Somerset man, born on 11 July, 1891, in Midsomer Norton where his father, I. B. Holmyard, a man of pronounced linguistic interests, was for many years a headmaster. Eric (he later preferred John) loved the county of his birth, where he spent most of his life. He was educated at Sexey's School, Bruton, not many miles away. In 1908 he entered Sidney Sussex College, Cambridge, where he read chemistry, physics, botany and zoology (1908–10), history (1910–11) and chemistry (1911–13). He obtained a first in the Natural Sciences Tripos, Part I, in 1910 and a first in Part II in 1912; in the meantime he had been awarded a second in the Historical Tripos, Part II, in 1911. In 1911–13 he was a postgraduate student in Cambridge

and in 1912–13 assistant demonstrator in chemistry. After a year (1913–14) with a research scholarship in agriculture at Rothamsted, he turned to teaching, which was to prove one of his enthusiasms, and became head of the Science Department at Bristol Grammar School, where he worked from 1914 to 1917. There followed two years (1917–19) as VIth-Form science master at Marlborough. He left Marlborough for Clifton where he was head of the Science Department from 1920, and here he remained, one of the outstanding chemistry masters in Great Britain, until in 1940 he was appointed the first editor of the new international scientific quarterly review, *Endeavour*, published by Imperial Chemical Industries, a post that he occupied with distinction and from which he retired in 1954. His last contribution to that review, "Alchemy in medieval Islam" (1955, **14**, 117), published after his retirement, reflects another main interest of his life.

While at Clifton, Holmyard was a member of the Committee of the Science Masters Association, of which he became Chairman in 1926, and he was also a member of the Bristol branch of the Society of Chemical Industry. In 1922 he was appointed an examiner in chemistry for the Joint Matriculation Board. About this time he began to publish text-books of chemistry for schools, such as *Inorganic Chemistry* (Arnold, 1922) and *Practical Chemistry* (Bell, 1923); they were characterized by an improved style and presentation and were immediately hailed by the reviewers. They were the forerunners of many that enjoyed remarkable success. He continued this work for many years and wrote or edited a large number of school textbooks of science, not only of chemistry, but also of physics, mechanics, botany and biology, and general science. It was said more than a few years ago that over a million copies of these books had been issued. Though his works in this field and in the history of chemistry were so very considerable, it is interesting to find that his first publication was *Marriages at Butcombe Somersetshire 1605–1835* (privately printed in London in 1913), transcribed from the parish registers in collaboration with Miss E. E. Britten, who later became his wife.

Historian as well as chemist both by inclination and by training, Holmyard was deeply interested in every phase of the history of chemistry. The first of his works in this field was the small but admirable survey, *Chemistry to the Time of Dalton* (Oxford University Press, 1925). His growing interest in the chemistry of Islam was marked by his learning Arabic so that he might study the original manuscript sources, and by the publication with an Introduction of a facsimile reprint (Dent, London, 1928) of Richard Russell's translation (1678) of *The Works of Geber*. Then came his *Makers of Chemistry* (Oxford, Clarendon Press, 1931), a well-written one-volume history of chemistry from early times. His last book in this field was the excellent study, *Alchemy*, a Pelican Book published in 1957. Written in his characteristically fluent prose,

it is a work of great merit and reveals a sympathetic understanding and deep knowledge of one of the most confusing and difficult phases in the history of chemistry. An Italian translation has appeared and it is understood that French and Spanish translations are about to appear.

In the meantime, Holmyard had published a series of papers on Islamic chemistry that marked a revival of interest in that subject. His "Arabic Chemistry" (*Science Progress*, 1922, **17**, 252) gave a general account of the chemical ideas and experiments of the Muslims and described succinctly the various steps that they supposed to be necessary for the processes of transmutation; this was followed by "Some Chemists of Islam" (*ibid.*, 1923, **18**, 66) and "The Present Position of the Geber Problem" (*ibid.*, 1925, **19**, 415). Similar studies were described before the Royal Society of Medicine (*Proc. R. Soc. Med.*, Section of the History of Medicine, 1922–23, **16**, 46). Simultaneously, there came a series of papers in *Chemistry and Industry Review* (1923, **1**, 387, 817, 958 and 976) on "Chemistry in Medieval Islam", "The Latin Works of Geber" and "A Critical Examination of Berthelot's Work upon Arabic Chemistry". Other relevant contemporary contributions appeared in *Nature:* "Arabic Chemistry" (1922, **110**, 573); "The Identity of Geber" (1923, **111**, 191); "The Emerald Table" (1923, **112**, 525) and "Accuracy of Weighing in the 8th Century" (1925, **115**, 963). Further researches were "Muslama al-Majriti and the Rutbatu' l-Hakim" (*Isis*, 1924, **6**, 293), "A Critical Examination of Berthelot's Work upon Arabic Chemistry" (*ibid.*, 1924, **6**, 479) and "Abu'l-Qasim al-Iraqi" (*ibid.*, 1926, **8**, 403). In 1923 he had published a translation of Al-Muktasab, a work by Al-Iraqí, *The Book of Knowledge acquired concerning the Cultivation of Gold* (Geuthner, Paris); in 1927 (with D. C. Mandeville) came his *Avicennae de congelatione et conglutinatione lapidum, being sections of the Kitab al-Shifa* (Latin and Arabic texts with English translation from the Arabic of *The Book of the Remedy* and critical notes: Geuthner, Paris). The first part of the first volume of *The Arabic Works of Jabir ibn Hayyan* (Arabic text only) was published in 1928 (Geuthner, Paris), but no further parts appeared. Other publications in this field were "Arabic Documents from the Monneret collection" (with D. S. Margoliouth in *Islamica*, 1930, **4**, 249); "Mediæval Arabic Pharmacology" (*Proc. Roy. Soc. Med.*, Section of the History of Medicine, 1935–36, **29**, 99); and "Aidamur al-Jildaki" (*Iraq*, 1937, **4**, 47). There was also a note on "An unpublished letter of Lavoisier" (*Nature*, 1932, **130**, 97), indicating Holmyard's detailed interest in the chemistry of an age other than that of his own special studies.

The Great Chemists (Methuen, London, 1928) was a short but interesting survey of the growth of chemistry in a series of biographical essays on its great experimenters and discoverers. In the same year there appeared his facsimile reproduction of *The Ordinall of Alchimy. Written by Thomas Norton of*

Bristoll, from the *Theatrum Chemicum Britannicum* with Ashmole's annotations. Norton was a Somerset man whose work naturally attracted Holmyard; the reprint was a worthy tribute to an interesting English alchemist of the fifteenth century. A later and minor study was his *British Scientists* (Dent, London, 1951) with an attractive series of twenty-four portraits.

Holmyard's most extensive activity in recent years was his co-editorship of the *History of Technology* (Clarendon Press, 5 vols., 1954–58), in which his knowledge of the history of science and of its applications were invaluable to his colleagues. Through his editorship of *Endeavour*, he was strikingly successful in presenting current advances in various branches of science to those who were interested in or specialized in others; and perhaps it was here that he made his greatest editorial contribution. It was in *Endeavour* and in *The History of Technology* that his rare combination of knowledge and experience was brought fully into play; and as scientific editor he had happily fused the rôles of scientist, historian, teacher, interpreter and man of letters. The number of his editorships was itself remarkable; he edited the Pelican Science Series; he was Scientific Editor to *Everyman's Encyclopaedia* and to Messrs. J. M. Dent & Sons; he edited Bell's *Natural Science Series*; and he was Chairman of the Council of the *World List of Scientific Periodicals*.

Holmyard's researches on Jabir ibn Hayyan and on the Geber problem were of outstanding importance; they revived interest in a subject that had not received much close attention since Marcellin Berthelot had published his *La chimie au moyen âge* (Paris, 1893, 3 vols.). From a study of certain Arabic texts of Jabir, Berthelot had concluded that the Latin works of Geber were European forgeries of the thirteenth or fourteenth centuries. As Berthelot had a good knowledge of Greek, no exception could be taken to his work on Alexandrian chemistry or to his study of its manuscript sources. But Holmyard rightly criticized the method by which Berthelot, knowing no Arabic, revised a translation prepared for him by Houdas, a distinguished Arabist who knew no chemistry; conclusions reached by this method, he argued, lacked a sound basis. With regard to his general conclusions on Muslim chemistry, Holmyard pointed out that Berthelot had not studied the whole field of Muslim chemistry but had neglected four centuries of its greatest activity. Berthelot had shown that the Latin works of Geber could not have been translated from the Arabic texts that he had studied, but his unsatisfactory and incomplete examination of sources did not exclude the possibility that they had been translated from or were based on other originals that had not been examined or were still unknown. Furthermore, Holmyard urged, Berthelot's account of Jabir's knowledge of chemistry was inadequate; for he had examined only nine texts, and these unrepresentative ones, from eighty that were available. Support for Holmyard's contentions came with his discovery of two Arabic treatises

by Jabir already known in a Latin translation made by Gerard of Cremona (1114–87); until this discovery was made, no work of Jabir or Geber was known both in Arabic original and Latin translation. Holmyard went on to identify Jabir as an alchemist, who was born in 721 or 722, who held a Court appointment under the Caliph Harun al-Rashid and who may have been still living in 803.

In his other papers on Muslim chemistry mentioned above, Holmyard added to our knowledge of this subject with regard to its great names, its theories, its experiments and its apparatus; and his work brought about a greater interest in and an improved understanding and appreciation of the work and writings, not merely of Jabir, but of the Muslim chemists in general. Later views, while in agreement with Holmyard's broad conclusions, would date much of the Jabirian corpus, in the recensions in which it has survived, as later, perhaps as late as the tenth century. This does not, however, detract from the value of his contribution to this difficult problem.

Holmyard's original historical work was acknowledged in 1928 when he received from the University of Bristol the degree of D.Litt. In 1929 he was elected a corresponding member of the Académie Internationale d'Histoire des Sciences. He was elected a Fellow of the Royal Institute of Chemistry in 1924. In the *Journal* of the Institute (1939, **63**, 3) he contributed an editorial on "The Study of Chemical History", in which, as he wound his way into his subject, he characteristically described Mr. Henry Ford's famous words on history as a 'graceful aphorism'.

Holmyard was a quiet and scholarly man, somewhat reserved on first acquaintance, tolerant of opinions that differed from his own and not given to disputation. In conversation with his friends he would draw on his great store of reading in a most pleasant way; in correspondence he proved himself a master in the art of delicate expression and could encourage or console in a way given to few; from the lives of those who were priviliged to know him well, his death has removed the stimulus of a robust mind and character and the attractions of a very amiable, gentle and kindly personality. That he remained a countryman at heart was reflected in his love of horses, of which he was a good judge, and in his interest in and support of horse-shows; to one who, in this mechanical age, shared these tastes with him, as I did, his conversation on these matters is a pleasant and enduring memory.

In 1916 Holmyard married Ethel Elizabeth Britten of Midsomer Norton, with whom he had collaborated in his first publication; she died in 1941, leaving two sons of the marriage. At his funeral at Clevedon on 17 October the Society was represented by the Hon. Editor, Mr. Desmond Geoghegan, and the Hon. Treasurer, Dr. W. A. Smeaton.

D. McKie.

DE LAPIDIBUS

By Lynn Thorndike*

This paper is in three parts. First are considered manuscript texts on twelve gems, then longer and usually alphabetical accounts which seem more or less related to the book on stones in *De natura rerum* of Thomas of Cantimpré, finally the *Lapidarius* composed for Wenzel II of Bohemia (1266–1305).

I.

A number of texts on twelve gems are found in manuscripts of the 11th, 12th and later centuries[1]. In most cases the twelve stones are those of the new Jerusalem[2] rather than those in the breast-plate of the high priest[3]. In some cases they are neither.

Of several texts in manuscripts at the Stadtbibliothek, Berne, the first that we note is metrical: MS. A.92.26, 11th–12th century, fol. 1r.a–v.a, "Carmen de xii lapidibus pretiosis versuum 123", opening concerning jasper, "Hic lapidum varius color est et mistica virtus . . .". For the most part its verses differ from those of Marbod on the gems in question.

In Berne A.91.11, of the 12th century, at fol. 1v., a brief paragraph *De cristallo*, which opens, "Hic lapis clarior est omnibus lapidibus. Nascitur autem in frigidissimis locis . . ." is followed by *De naturis xii lapidibus*, opening, "Iaspis viridis ac pressi coloris est . . ." and proceeds to state the colours of sapphire, calcedon,

> Calcedonius rubeum habet colorem sed tamen obscurum nisi cavendo atenuatur. Ipsa vero concavitas pulcherrimum ei colorem et gratissimum confert . . .

emerald, sardonix, sard, crisolite, beryl, topaz, crisopassus, iacincth and amethyst. It then reconsiders the twelve stones in more or less the same order, and chiefly as to their colours.

* Columbia University, New York.

[1] A MS. which I have not seen is dated in the printed catalogue as 10th century: Orléans 343, p. 141, opening, "Diversitates duodecim lapidum . . .".

[2] Revelations 21, 19–20, in the order: jasper, sapphire, chalcedony, emerald, sardonyx, sard, chrysolithus, beryl, topaz, chrisoprasus, jacinth, amethyst.

[3] Exodus 28, 17–20, but the order and even one stone differ in the Vulgate and in the King James' version. In the Vulgate: sardius, topazius, smaragdus; carbunculus, sapphirus, iaspis; ligurius, achates, amethystus; chrysolithus, onychinus, beryllus. In King James': sard, topaz, carbuncle; emerald, saphhire, diamond, ligure, agate, amethyst; beryl, onyx, jasper.

A MS. at the Vatican which I have not seen is Palat. latin 1237, 16th century, fol. 1–, "De duodecim gemmis que erant in veste Aaronis", opening, "Sardius rubeus . . .".

In Berne A.92.27, 11th–12th century, fols. 1r.–3v., the twelve stones of the heavenly city are considered in the usual order. The opening words, "Gemma dicta est eo quod ad instar gummi transluceat . . ." are drawn from Isidore of Seville, as is the next sentence, "Genera autem gemmarum innumerabilia sunt sub quibus nos ea tantum que principalia fere sive notissima adnotavimus". But in Isidore it precedes the other[4]. Our text begins with jasper which is the eighth stone in Isidore, and at first copies his account but then adds:

> Viridis ergo coloris est. Quem qui super se habuerit nulla fantasmata timat. Hic lapis significat eos qui fidem dei tenent semper, numquam arescunt ab ea, sed semper virent in ea. Nec timent fallacias diaboli qui tamquam leo rugiens circuit querens quem devoret, cui resistunt fortes in fide.

The account of the emerald, on the other hand, is totally different from Isidore's:

> Iv, Nascitur in Sertia[5] que est inhabitabilis terra pro frigore, nec ibi habitant nisi grifes qui sunt bestie et volucres qui habent iiii pedes et sunt similes leonibus corpore. Capite et pedibus et aliis membris sunt similes aquilis. Et illa terra nimis habundat talibus gemmis et predicti grifes servant illas ita ut nullus possit illas capere nisi Arimaspi gens[6] que non habet nisi unum oculum in fronte. Et isti tales pugnant cum grifibus pro his gemmis. . . . Et per illos Arimaspos habemus nos illas[7].

After the account of the twelfth and last stone, amethyst, has concluded as follows:

> Et bene hic lapis ponitur extremus in edificio civitatis dei, nam hec est virtus maxima supra quam nulla est, orare scilicet pro inimicis, et paucos invenimus qui hoc faciant,

[4] Etymologiae XVI, vi, De gemmis. Isidore's subsequent arrangement is entirely different than that of texts on twelve stones, since in cap. vii he considers 16 green stones, then in the following chapters, red, purple, white, black, and varied stones; then crystals, xiv de ignitis, and xv de aureis.

In an anonymous text in MS. Sloane 1784, 14th century, at the British Museum, which will not be considered further here, since it has been edited by Joan Evans, *Magical Jewels*, 1922, the gems are listed at fol. 1r., both in what are called God's and John's order. Other texts edited in the appendices of *Magical Jewels* are, from the Bodleian, Hatton 76, early 12th century, fols. 131–139v.; Digby 13, 12th century, fols. 17–19v.; Digby 79, 13th century, fols. 178v.–179v.; E Musaeo 52, 15th century, fols. 44–47; and Rawlinson D.358, 15th century, fols. 81–91.

[5] Sicilia in Berne 416, fol. 4v.b. It should be Scythia.

[6] gens Arimaspum in Berne 416, fol. 4v.c.

[7] In Pliny, Nat. hist. VII, 2, it is for gold, not emeralds, that the Arimaspi and griffin contend.

our text continues concerning the heavenly city as described in Revelations and the significance of its dimensions. Of its twelve gates, that of crystal signifies baptism. Its four fronts denote the points of the compass and the ages of man. Some information is given as to stones other than the twelve. Pontica is a perlucid gem having red and golden stars[8]. As for pearl:

> Margarita illius natura quod coepit desuper totas tres portas simul et talis est et huic est natura unio eo quod unum est et non est simile ulli alii margarite et habet mirabilem naturam et vis invenitur nec usque nascitur nisi in quadam insula Caprobane in India et innascitur in rupibus illius insule. Rupes illius insule cum sint tote integre et sine crepidine et sponte sua inhiant et recipiunt rorem de celo et fiunt pregnantes et certo termino parturiunt et de se emittunt hoc margaritum (*sic*) quod dicitur unio et postea ita clauditur et quod dicitur nullum signum aperionis appareat

In another manuscript at Berne, 416 of the 12th century, fols. 4v.–5v., in triple columns, this conclusion about the heavenly city is omitted, as are the opening sentences borrowed from Isidore. It begins at once with the first stone, but somewhat differently, "Iaspis primus ponitur in fundamento civitatis dei . . ." rather than, "Primus lapis est iaspis . . .", as in the other Berne manuscript[9].

Berne 416 is further one of the few manuscripts to give the prose prologue of Evax to the poem of Marbod on gems. It immediately follows the text on twelve stones and consists of two letters:

> 5v.b Incipit prologus Evacis ad Tiberinum de diversis generibus lapidum. Desideranti tibi scribi a me mysteria omnium lapidum. . . .
> 5v.c Evax rex Arabie Tyberino imperatori salutem. Magnifica tua dona accepi . . .[10].

Then the poem begins at 5v.c–6r.

> Evax rex Arabum legitur scripsisse Neroni
> Qui post Augustum regnavit in orbe secundus

The same sequence occurs in a manuscript at the Bibliothèque Nationale, Paris: nouv. acq. lat. 625, 14th century, fol. 3v.b. It is preceded at fol. 3v.a by a brief *Probatio smaragdi*, which opens, "Si aspectus transmutant, si

[8] Fol. 3v., stellas, or stillas.

[9] In Migne's *Patrologia latina*, vol. 171, the poem of Marbod at cols. 1737–1770, is followed by a prose, *Mystica seu moralis applicatio*, at 1771–1774, which opens similarly, "Jaspis est primum fundamentum ecclesiae dei . . .".

[10] Only this second letter is given in Florence, Laurentian library, Ashburnham 1520, 14th century, p. 30a.

conglobosi sint, proxima sibi inficiant aere repercusso . . .". The poem of Marbod which follows in the sequence ends at fol. 9v.b:

> Follibus afflatum procul ignis viribus uti,

whereas in Latin MS. 6514 of the Bibliothèque Nationale, Paris, at fols. 33–37, it closes:

> De verbo faciet nomen qui tamen (?) retrovertet

and in Montpellier, Bibl. de la Faculté de Médicine, MS. 260, 14th century, fols. 112–116v.,

> mala malis dantur iustitiam est[11].

According to the fly-leaf table of contents in MS. nouv. acq. latin 625, there should come next an Exposition of the Twelve Stones in the Building of the City of Jerusalem, but it is not now at this place in the manuscript.

In a manuscript of the Nationalbibliothek, Vienna (latin 4694, 15th century, fol. 122v.), the twelve stones of Revelations are treated in their usual order, but with the unusual incipit, "Iaspis semper virens et visum confortat, id est, fides . . .". The text for the other stones is similarly brief. The sapphire signifies hope; the calcedon, charity; emerald, virginity; sardonix, patience. The sard stands for "the perfect constancy of the martyrs"; crisolite, for wisdom; beryl, for "virtus anime"; crisopassus, for "desiderium celestis patriae"; and the amethyst, for humility. Meanwhile, no significance has been given for the jacinth, concerning which it is merely stated:

> Iacinctus cum aere mutatur. In sereno perspicuus est, in nubilo obscurus,

while the text for Topazius has been omitted entirely.

In a Cottonian manuscript at the British Museum, Titus D.XXIV, 12th century, fols. 132v.–134v., the twelve stones are considered in the unusual order: crisolite, sapphire, beryl, calcedon, iacinth, cyanea (a newcomer), sardonix, amethyst, jasper, topaz, emerald and crisoprassus. The text opens:

> Crisolitus lapis[12] quasi aurum fulget scintillas habens ardentes cuius specie figurantur hi qui in (133r.) collectis (?) superne sapientie fulgentes verba exhortationis vel etiam virtutum signa proximis ministrant, quorum mentibus instar amor sermonibus estuat ardor. . . .

[11] For the last two MSS. see James Corbett, *Catalogue des manuscrits alchimiques latins*, **I** (1939), 19; **II** (1951), 83. I have failed to find any of these three desinits in the poem as printed in Migne, *Patrologia latina*, 171, cols. 1737–1770.

[12] A text in Orléans 307, 11th century, pp. 121–123, likewise opens: "Chrisolitus lapis . . .".

and closes:

> . . . Singuli lapides preciosi singuli sunt in fundamentis ecclesie deputati qui licet omnes perfecti quibus emicas dei nostri in monte sancto eius ornatur atque fundatur gratia sint luce fulgentes, alii tamen per spiritum datur sermo sapientie alii sermo scientie alii gratia sanitatum alii genera linguarum alteri fides in eodem spiritu et cetera.

In a manuscript of the 13th century at Erfurt, Amplon. Q.295, what Schum has catalogued as a single treatise at fols. 37r.–41v., may better be divided into two texts. In the former *Liber de duodecim lapidibus*, at fol. 37r.-v., the twelve stones are taken up in the usual order with their colour and spiritual significance. To the text is prefixed a rubric consisting of the distich:

> Qui lapidum vires et nomina scire requiris
> Ex lege me lecto rem cognosces ordine recto.

The text then opens, "Cives celestis patrie regi regum . . ." and closes " . . . intra sanctorum agmina cantemus tibi cantica". The second text opens:

> In nomine domini hic est liber preciosus magnus et sacratus sigillorum. . . .

and deals, as the last word suggests, with images found on gems, how such seals ought to be engraved, and finally how they should be consecrated. The same twelve stones are again considered in the same order, except that *cardomus* takes the place of *sardius*. Marvels are expected from such images on gems, and magical procedure is prescribed in their employment. There is a close resemblance to the work on such seals which Thomas of Cantimpré ascribed to Thetel[13].

In another manuscript at Erfurt, this time of the 14th century, Amplon. Q.368, fols. 71v.–74r., and in a paper folio at Basel, F.II.15, fols. 107v.–110r., is yet another text on twelve stones, which in the latter codex is catalogued (Haenel, p. 534) as "De lapidum pretiosorum natura cum magicis inscriptionibus", while in the text itself we are told that these stones are of such sublime efficacy that it is ascribed to nigromancy. It opens, "Diversa legens hec collegi labore nimio et expertus sum . . .". The twelve stones now are achates, adamas, allectorius, berillus, calcedonius, celidonius, corallus, crisopassus, echites, iacinctus, Iaspis, and the magnet. They are no longer associated with the heavenly city; indeed, only five of them were included in its twelve. The character of the text may be sufficiently illustrated from what it says of the first stone.

The agate is black and so dispels serpents that they would rather enter

[13] *A History of Magic and Experimental Science*, II, 389–91, 399–400.

fire than remain near it. Engraved *in argento* it aids the sight so that an old man sees better than a youth; keeps its bearer, if wounded, from dying; makes one *persona grata*, warms, and guards from perils at sea. It is hard and has blood-coloured spots. It is found especially among sailors. Its virtue may be tested by putting it in a vessel with a snake. If the reptile is found dead within an hour, the stone is of the best. If the snake survives for two or three hours, the stone's virtue is only mediocre. It should be kept in warm places, and is more potent in summer heat than in winter cold.

> Valde est necessarius ad complexionem sanguineam gestantem se inclinat. Expertus enim sum in potantibus desidiosis bibulis et mercatoribus concessi frequenter et ut dixi sic accidit eis.

In a manuscript at the Bodleian, Oxford, Laud. Misc. 203, fol. 107r.–v., twelve stones are associated with the signs of the zodiac as follows, and their colours and virtues noted in each case:

Calcedon	Aries
Ametista	Taurus
Dyasperon	Gemini
Berillus	Cancer
Chorcese	Leo
Cruosato	Virgo
Corallus	Libra
Leotropia bothora	Scorpio
Alamandine	Sagittarius
Allectorium	Capricornus
Rubinus	Aquarius
Balassir	Pisces.

This text was immediately preceded by another on nine stones, which were related to the seven planets and head and tail of the dragon. A tenuous connection with Jerusalem was maintained in its opening words: "Novem sunt lapides qui sunt in hostio Jerusalem qui continentur in planetis . . .". Their correspondence is:

Carbuncle	Sun
Sapphire	Venus
Thopasion	Mercury
Thauri	Moon
Sardonix	Saturn
Smaragdus	Mars
Sardia	Jupiter
Dyamas	caput draconis
Crissopassion	cauda draconis.

In a manuscript at Munich (cod. lat. 5964, fol. 298r.–v.) the sapphire

rather than jasper is the first of the twelve stones to be treated: "Saphirus est flavei coloris sicut celum serenum . . .". The subsequent order is: topaz, emerald, carbunculus, ametistus, onichinum, iaspis, crisolitus, berillus, ligurius, achates, concluding:

> Sardius est coloris rubei sed atri sicut terra rubea. Item restringit fluxum sanguinis. Item accendit animum ad gaudium et acuit ingenium.

At the Vatican, in Latin MS. reg. suev. 258, of the first half of the 13th century, amid several brief texts on angels, the insane, waters near Rome, movements of the body after the resurrection, divisions of time, and luxury, is a *De lapidibus*, at fol. 4r., which opens with the hyena stone and further considers pontica, cristallus and galactia. It presumably is a brief extract from some longer work and is followed by rubrics: "De hominibus" (monstruosis), "De baptismo" (5v.), "De Salomone" (6r.), "In Apologia David" (6v.), and so on. After an elaborate bestiary with finely drawn figures at fols. 8r.–42v., *De duodecim lapidibus*, at 42v.–44r., opening, "Duodecim lapides positi sunt in fundamento civitatis celestis Ierusalem . . .", considers the usual stones from jasper to amethyst with especial attention to what they signify, as a few quotations will illustrate:

> Primus lapis ponitur iaspis qui est viridis ac pressi coloris quem qui super se habuerit nulla fantasmata timet. Et significat fideles qui a vitiis abstinentes viriditas eorum, idest fides, ex actibus mundi aliquantulum fulscentur, tamen operibus bonis redimunt peccata sua, qui semper virent per fidem dei et numquam arescunt in ea nec timent fallacias diaboli.
>
> Quartus est smaragdus qui est eximie pulchritudinis et viriditatis in tantum omnes ut herbas superat viriditate sua et etiam omnia que circa se sunt inficiat. Significat sanctos predicatores qui plus aliis virides sunt in fide et aliis virtutibus et superant infideles frigidos fide et caritate, qui semper arserunt splendorem suum circumquaque super omnes alios. Huius sunt plura genera sed preciosi nascuntur in Sicilia et frigida terra quos servant griphes quadrupedati et alati, cum quibus pugnant arismaspi monoculi ipsosque eis auferunt. Griphes isti significant malignos spiritus invidentes fidem habentibus, qui transvolant per aera et currunt per terram ut possint aliquem devorare. Cum istis pugnant arismaspi monoculi idest electi habentes unum oculum mentis ut sibi vendicent hunc lapidem preciosum.
>
> Septimus est crisolitus quasi aurum fulgens scintillas ex se mittit. Significat sapientes qui splendorem superne sapientie fulgent sicut aurum suas virtutes cum verbo predicationis valde in primo effundunt. Et ideo aurei dicuntur.
>
> Duodecimus est ametistus qui est tricolor, idest purpureus, violatus

a viola, roseus. Per purpureum colorem intelligatur regale ornamentum quod fit de purpura. Significat apostolos et eorum similes qui ornamentum summi regis fuerunt, quia eum per totum orbem predicaverunt, et ideo tenent celestem principatum. Per violatum humilitas cum ardore boni actionis. Per roseum caritas et martyrium sanctorum quia roseus color similis est sanguini.

A final paragraph then rapidly recapitulates the significations of the twelve stones:

Omnes ergo simul lapides ista significant. Iaspis homines intemerate fidei. Sapphirus quorum conversatio in celis est. Calcedonius pacientes. Smaragdus quorum fides aliorum superat infidelitatem. Sardonius humilia de se sentientes. Sardius sanguinem pro domino fundentes. Crisolitus sapientia sua alios illuminantes. Berillus deservientes contemplationi et actioni. Topazius perfectos omni virtute. Crisoprassus fide et sapientia splendentes. Iacinctus omnibus morum qualitatibus se contemperantes. Ametistus orantes pro inimicis in persecutione ut Stephanus et alii plures. Hec sunt duodecim virtutes que vocantur etiam xii margarite que bene conveniunt xii apostolis et sequacibus eorum.

After the rubric, "Lapides quos vocant terrobolem. Masculus femina", a blank space equivalent to about ten lines intervenes before the corresponding text, which opens, "Sunt lapides igniferi in quodam monte orientis qui grece dicuntur terobolem . . .". While they are far apart, fire is not kindled in them. But when by chance the feminine variety approaches the male, fire is immediately kindled, so that they burn up everything about that mountain. This brief text is also found in a manuscript of the 12th–13th century at the British Museum, Burney 327, fol. 84, and in latin MS. 11207, 13th century, of the Bibliothèque Nationale, Paris, fol. 76r. The stone is also treated by Thomas of Cantimpré, *De natura rerum*, in Univ. Graz, 1249, 13th century, and in a Klagenfurt MS. to be mentioned presently.

There follows, at fols. 44v.–45r., another brief paragraph concerning a stone in the sea called *coccus*, hollow and round, and divided into two parts which it opens and closes at will. In morning hours it ascends from the depths of the sea, with flesh inside itself, and when it rises above the surface, opens its mouth and receives the dew of heaven, and the sun encircles it with its rays, and thus there is made in it a splendid and precious pearl, because it is conceived by the dew of heaven and clarified by the rays of the sun. It typifies the Virgin Mary. This account of the origin of pearls reminds us of that which we have already quoted concerning the cliffs of Ceylon in MS. Berne A.92.27.

II.

Verses concerning gems found in later manuscripts are apt to be extracts from the 11th-century poem of Marbod. The book on stones of the 13th-century encyclopedia, *De natura rerum*, by Thomas of Cantimpré, is to a large extent a prose version of Marbod, with addition of the work of Techel or Tethel on images on stones, and other matter concerning the sculpture and consecration of gems. Similarly, anonymous prose accounts of stones in subsequent manuscripts are apt to be closely related to Thomas's presentation.

For example, on 28 July, 1959, I examined a text on stones in a 15th-century manuscript of the Studienbibliothek in Klagenfurt, Pap. Hs. 167, fols. 157r.a–164r.b, which opened, "Ametistus lapis est de xii lapidibus preciosis . . .". This incipit might seem to suggest a treatise on the twelve stones either of the high priest or the new Jerusalem, such as we have been considering. But at fol. 162v.a, "Secuntur relationes antiquorum scriptorum de sculpturis lapidum"[14]; at 163r.b, "Sequitur libellus cuiusdam phylosophi Iudeorum Tethel"; and at 164r.b, a closing prayer for the consecration of stones, brought Thomas of Cantimpré to mind.

Two days later at Graz, where a good manuscript of the second half of the 13th century of the version of *De natura rerum* which opens with the seven regions of air[15] was available: University library 1249, a small quarto of 114 leaves, I compared the treatment of particular stones, in rough alphabetical order, with that of the Klagenfurt MS. (see Table I for its list of stones) and found them identical except for minor variations in spelling, and the omission in the later manuscript of some stones found in Graz 1249: Lagapis, Myrtum, Nychamar, Peanites, Prasius, Syrum, Sarcophagos, Samius, Specularis, and Sardo. Most of these will be found in the longer list reproduced in Table I from Vienna Latin 2303.

At Vienna, Latin manuscripts 407 and 2301 at the Nationalbibliothek, both of the 14th century, at fols. 145v.–147v., and 81r.a–v.b, respectively,

[14] On images engraved on stones see my "Traditional Medieval Tracts concerning engraved astrological images", *Mélanges Auguste Pelzer*, Louvain, 1947, pp. 217–74. Although five treatises are here ascribed to Solomon (pp. 250–252), they do not include, in Florence Laurentian Ashburnham 1520, 14th century, pp. 55a–58b: "Lapidum preciosorum diversa sunt genera . . ./. . . Explicit Liber lapidum preciosorum secundum Salomonem regem Iehrusalem"; nor 58b–62b: Incipit liber consecrationum eorundem secundum eundem partim et partim secundum quosdam Saracenos. Salomon sapientissimus rex Ierhusalem librum de natura lapidum . . ./. . . Expliciunt exorcismi lviii preciosorum lapidum partim a Salomone rege partim a Saracenum argutis partim a Grecis . . .".

[15] See my *History of Magic and Experimental Science*, **II**, 396. I hope soon to publish a fuller, separate treatment of different versions of *De natura rerum* of Thomas of Cantimpré. The work has never been printed and is found anonymously in many of the manuscripts.

give roughly identical non-alphabetical treatments of stones beginning with the lynx-stone or *Ligurius*. The stones considered in 2301 are:

(I make some comparison with the text of Thomas of Cantimpré in MS. 2357, 14th century, fols. 1r.–46r.a, of the version beginning with the Seven Regions of Air.)

Ligurius
Berillus
Ceraunus
Panthera *or* Pantheros
Galatida (Galaritides in Thomas); "Balatida" in 2301
Adhamans
Achates (minor variations from Thomas)
Electorius (texts compared in Table III)
Iaspis (a different order and wording from that by Thomas)
Saphirus
Calcedonius (texts compared in Table II)
Smaragdus (8 lines as against 25 of Thomas)
De sardone (very different from Sardonix in MS. 2357)
Sardius (2357 is longer and quite different)
Onix
Topaçion
Iacintus
Amestitus
Celidonius
Agates
Magnes
Carbunculus
Echides
Margarita

Supplementary matter follows in 407 and 2301. No gem can sustain fire except sapphire and adamant. None is harder than these two, and none softer than emerald.

> Nota etiam quod saphirus ferinus igne crematur, sed albus vel croceus saphirus non crematur.

Some sapphires are soft but "saphirus citrinus qui est quasi albus" is hard and endures fire and is nobler and better than saphyrus ferrinus.

> Iaspis parinthicus multum valet contra sanguinem et est quasi in calcidonibus campis sanguine respersus, id est, rubeis guttis.

Lapis pirridori, turcus, adamas, corallus and cornelia are discussed.

> Adamantes quidam in Scicilia reperiuntur, quidam etiam in Lombardia, quidam ultra mare, sed adamantes Indici hiis omnibus meliores. In Podio sex saphyrorum genera inveniuntur que omnes ignem sustinere possunt. Sunt enim lazurii coloris, alii nigri, alii citrini, alii fere ferrini, alii crocei tamquam iaspides. . . .

A treatise on physiognomy follows in MS. 2301[16], but in 407 another *Lapidarius*, at fol. 147r.b–v.b opens and closes:

> Conspicuus prassinus gemmis solet annumerari . . ./. . . nam que nox celat solito lux more revelat.

It turns out to be the last third of Marbod's poem: Migne, *Patrologia latina*, 171, cols. 1762–1769. Under the caption, "Nomina omnium gemmarum et lapidum preciosorum", fifty-two are listed, with further brief accounts only of Aquilinus and Pretonissus, stones which are not treated by Marbod.

Vienna Latin MS. 2303, 14th century, fols. 62r.b–64r.b, considers an alphabetical list of stones similar in order but somewhat more numerous than those of Thomas of Cantimpré. Its list is reproduced in Table I; its text for Ametistus and of Alectorius is set opposite others in parallel columns in Tables II and III.

Going back to Vienna 407, I quote from it at length a passage on polishing gems which seems peculiar to it.

Ad Poliendum Gemmas et Faciendum

(from Vienna Latin MS. 407, 14th century, fol. 147r.ab)

Ad poliendum duras gemmas scilicet saphirum rubinum iacinctum et alias accipias unum nigrum lapidem qui reperitur inter c'talem (cretalem?) lapidem, et igne examinetur ut argentum, et post quemlibet examinationem aqua refocilletur, et teratur sicut minium, et utatur eo.

Item ad molliores gemmas recipias fecem ex lapsatis sinerillis et infacias pastillum vel plures et decoquetur sicut argentum vel aurum ductile in fornatello, et quotiens accensum fuerit tociens in aqua refrigeretur ut supra, et illud teraur ut supra.

Item ad faciendum duplas, accipias gumi arabicum et inpone in lixivium donec molle fiat, et recipias clarum purissimum tantum de et ponas in pannum mundissimum et cola per illud. Et de illo limas cristallos et coniungas et ponas ad solem in estate et non in hyeme, et compactum sale in aqua perpetuo perdurabit.

Item accipe masticon et inpone ligno ad ignem et calefacta premas eius succum pollice extra suam pelliculam et illa premaitate (?) limas lapidem vel cristalla et coniungas et perpetuo perdurabit.

Item lac'os (?) Saracenici poliunt omne vitrum.

[16] In the top margin of fol. 81r.a of MS. 2301 is written the rubric: "Iste sunt lapides quorum virtutes misit Aristotiles in scriptis maximo imperatori Alexandro"; but, like many such rubrics, it seems unauthoritative.

Omnes lapides terantur primo in plumbo; deinde, si sunt duri, in cupro, non auricalco, cum sinerillo bono. Et cum fuerunt competentur politi, tunc in alio plumbo magis venusto in fece subtili et cocti sinerilli velut minio contrito, et postmodum primo in cupro poliantur, in fine in ligno; si molles gemme fuerunt quod vulgariter exlenis holx dicitur quod sit valde siccum.

Item de religis et micis cristallinis igne ut gradu (?) decoctio et aptritio (?) cristalli poliuntur. Et cum sinerillo poliuntur ut supra (*147r.b*).

Saphiri de podio (le Puy?) et omnes gemme de podio in plumbo et ligno, non in cupro poliantur, quia in cupro destruerentur.

Nota quod, quando operari oportet per gumi arabicum, inponatur gumi et clarobrisilium vel lazurium aut alius color, et talis coloris lapides erunt.

Nota quod quatuor gemme scilicet rubinus smaragdus topazius et saphirus ferrinus poliendo unum colorem requirunt. Omnes alie gemme saphiretice et alie cuiuscunque generis uno colore poliri poterint et ornari.

A 15th century manuscript in the Ambrosian library at Milan, P.21, sup., fols. 191r.–202r., contains about the same number of stones as that at Klagenfurt: rubric, "Incipit liber lapidarius de virtutibus eorum et unde nascitur (*sic*) et sunt 69". But in the table of contents at fols. 202v.–203r., an alphabetical list of only 68 is given. It is reproduced in Table I. It opens with Abestos rather than Amethyst, "Prima abestes vel abesto est lapis ferrei coloris et nascitur in Archadia regione Amazonum . . .".

In a Barberini manuscript at the Vatican, a composite collection of nine codices of different dates, that which is designated as "De lapidibus et eorum coloribus", of the 15th century (Barb. lat. 343, fols. 33–37v.) treats in alphabetical order of some 106 stones, beginning, "Adamas est lapis preciosus obscurior cristallo . . .". Often only a single line is devoted to a stone. Nor are their colours always specified, while the stress on their magical virtues may be illustrated by two examples, one the familiar hyena-stone, which dates back to Pliny, the other the less familiar quirn, quirim or quindros.

> Hyene lapis ab oculis hyene animalis extrahitur. In ore tentus facit futura predicere; valet temerariis et illis qui intendunt et vacant maleficiis (fol. 35r.).
>
> Quirn in nido upupe reperitur. Sic secreta prodit in insomniis et auget fantasias. Si vero ponatur super pectus dormientis, respondebit ad interrogata ab ipso (fol. 36v.).

TABLE I

Milan Ambros. P. 21. sup. 15th century, 1911.–202r.	Vienna Latin 2303.	Klagenfurt S.167 (Graz 1249 spellings in parentheses).
Abestes vel abesto	Abeston	
Absciams	Adamus	Ametistus
Abesictus	Absinctus	Achates
Achates	Agathes	Adamas
Adamas	Alabandina	Abeston
Alabasentes	Alectorius	Amanthes
Ancitestus	Amandinus	Allectorius
Andromada	Amestistus	Absinthius
Asius	Adromanda	Alabandya
Atheletorius	Alagius	Amandinus
Berillus	Berillus (Aerillus)	Andromandra (Androdramanta)
Calcofonos	Carbunculus	Berillus
Calculus	Calcedonius	Borax
Carbunculus	Calcophonos	Carbunculus
Celigotus	Ceraunus	Calcedonius
Celidonius	Celidonius	Corallus
Celonices	Cholonides	Crisopassus
Ceraunus	Cagolites	Celidonius
Corallus	Corallus	Calophagus
Corneolus	Cornelius	Cristallus
Crisolitus	Crisopassus	Crisolitus
Crissopassus	Crisolitus	Cerauna
Crisolutas	Cristallus	Corneolus
Crisopacion	Crisolitus (again but with different text)	Crisolitus (again)
Cristallus	Crisopasum (again but with different text)	Celonites
Cristalinus	Dertus (Dyamon)	Cegolites (Egolitus)
Damus	Diacodos	Crisopasion
Dyaconos	Damilia	Cemonius (Cos and Demonius)
Dionixia	Draconides	Dracontides
Ebonites	Ethites	Dionysia
Elleutropia	Elitropia	Dyachotos
Emathites	Emathides	Emachites
Enidios	Epistrites	Echites
Epistites	Eracolitus	Elyotropia
Exacontalitos	Exaconlitus	Epistutes
Echites	Falcones	Exacolitus
Fenichites	Gagaches	Elydros *or* Enydros
Gagates	Gogac'mento	Granatus
Galaetites	Gelasia	Gagates
Galactica	Galactides	Gelasua
Gorgatromeus	Gerchidus	Gegolitus
Grachites	Gecolicus	Galantides (Galaritydes)
Hyena	Granatus	Gegatoneus (Gegatroneus)
Iacinctus	Iaspis	Gearchyges
Iaspis	Iacinctorum duorum sunt genera	Iaspis
Ibnites	Iena	Iacinctus
Kiperea	Iris	Iris
Ligurius	Iscustos	Hyena (Iena)
Magnes	Kakabie	Ligurus (Ligurius)
Medus	Kabraces	Magnes
Molochites	Kamar	Memphites
Onix	Ligurius	Medos
Optalius	Lipparea	Nothe
Orites	Magnes	Onichinus
Panteron		Onix
Peanites		
Pirites		

TABLE I (*continued*)

Milan Ambros, P. 21. sup. 15th century, 191r–202r.	Vienna Latin 2303.	Klagenfurt S.167 (Graz 1249 spelling in parentheses).
Parassius	Margarita	Oscolanus
Sada	Medo	Orites
Saphirus	Melochites	Perydes vel Peridonius (Perites)
Sardius	Meraphites	Panthera (Prasius)
Sardonicus	Machasia	Quirindros (Quirin)
Setinonius	Magnesia	Saphyrus
Sylenites	Nitrum	Smaragdus
Smaragdus	Nichomar	Sardonix
Topacius	Onix	Sardius
Unio	Obtalmius	Succinus
Yris	Orites	Sylonites
	Orphanus	Topasius
	Panterus	Trebolen (Terebolen)
	Plenites	Tertillus
	Prassius	Zunich vel lapis lazurii (Ternix)
	Quirim	Zinginus (Zignites)[17]
	Quindros	
	Raday	
	Saphirus	
	Sardonix	
	Sardius	
	Serda	
	Saloenites	
	Smaragdus	
	Sirus	
	Sarcophagus	
	Sinus	
	Sucenius	
	Specularis	
	Topazion	
	Turaxius	
	Tarach	
	Terinx	
	Trices	
	Vemeth	
	Vagnites	

TABLE II

Ametistus

Vienna 2303, 14th Century, fol. 62v.a.

Ametistus est gemma multum communis et nota quod est coloris purpurei transparens aliquantulum obscurus et non inveniuntur communia specie multe differentie s.v. sunt nigre note perditionis (?) obscuritatis omnis accepte. Nascitur autem molior ad sculpendum eo quod aliis est minus durus. Operatur autem contra ebrietatem ut dicit Aaron et facit vigiliam et malos reprimit cogitationes, et bonum in scibilibus est auxilium.

Klagenfurt, Studienbibliothek 167, 15th century, fol. 157r.a; Graz 1249, 13th century, Thomas of Cantimpré.

Ametistus lapis est de xii lapidibus preciosis. Hic est violatei sive purpurei coloris et hic est optimus. Est autem que est velut gutta rubei vini aqua corrupta et hec facilius sculpitur. Ebrietatibus contrarius est, facit vigiliam, malam reprimit cogitationem, bonum confert intellectum. Carior esset hec (!) lapis, si maxima eius copia non esset. In Ethiopia et in Ynndia invenitur. In Germania etiam sed vilius et obscurius.

[17] This stone is found elsewhere under such varied spellings as Ibnites, Tignites and Vagnites. Other stones in Graz 1249 are Syrum, Sarcophagna, Samius, Specularis, Sardo.

TABLE II (*continued*)

Calcedonius

Thomas of Cantimpré in Vienna Latin MS. 2357, fol. 41v.a.	Vienna Latin MSS. 2301, fol. 81r.b and 407.
Calcedonius lapis est vii de xii ebetis coloris et crassi super pallore detentus. Color eius inter iacinctum et berillum medium est qui si pertusus id est perforatus sit et collo feratur vel digito, causas vincere dicitur. Cuius lapidis tres species dicuntur.	Calcidonius est lapis pallidus (407 omits) lucens mediocris inter iacinctum et berullum.
	qui dicitur tamen tres habere colores.
Temperat calorem febris calcedonius qui pallenti lucerne similis est et fulget magis sub divo quam in domo. Calefactus a sole vel a digitorum tactu paleas ad se trahit. Sculpentium argumentis resistit.	Virtus eius est maxima quia gestantibus prestat eloquentiam et victoriam in litigiis causarum et in iudiciis.
Fugat caritatem que intus in corde celata pallet . . . etc. (religious and moralizing).	

TABLE III

Thomas of Cantimpré in Vienna Latin MS. 2357.	Vienna Latin MS. 2301.	Vienna Latin MS. 2303.
Allectorius lapis est ad mensuram fabe cristallo prope similis sed paululum turbulencior. Hic nascitur in ventri galli qui post tres annos castratus et postea vi annis vivens hunc portat. Hic lapis ore gestatus sitim extinguit victoriosus est pacem reconciliat homines refertur discretum facit et gratum et maxime uxores maritis ut etiam hec omnia habeat clausus in ore portetur.	Electorius gloriosus lapis nascitur in ventre galli galinacei scilicet qui suis testiculis est privatus. Et informatur in ventre galli galinacei in tercio anno et per iiii annos suscipit incrementum donec perveniat ad magnitudinem fabe et est cristallo similis et lactei coloris. Hic lapis maxime laudis est. Virtutes eius nature et proprietates sunt.	Alectorius est gemma que vocatur lapis galli et est albus virens cristallo obscuro similis. Extrahitur autem de ventriculo galli gallinacii postquam fuit ultra quartum annum castratus et quidam dicunt quod post nonum annum extrahitur et est melior qui de gallo decrepito extrahitur. Maxima autem huius quantitas est inventa ad quantitatem fabe.
	Portator eius est inexpugnabilis et sub lingua positus sitim extinguit et propter victoriam acquirendam et prelia superanda deferunt ipsum reges. Dicunt etiam quod exules et expulsos ad propriam patriam reducat et gestantibus acquirit semper novos honores.	Virtus autem huius est excitare Venerem, gratum et constantem victorem, et dasaum (?) facere oratoriam tribuit facultatem.
	Ad usum Veneris multum confert et reddit mulieres amabiles viris. Tamen ut hic hora habeat clausus deferatur in hore quia tunc maiores habet virtutes.	Amicos conciliat et gestatus sub lingua cachinum reprimit,
		et hoc ultimum expertum est.

III.

A manuscript of the 15th century at Berne[18] is entirely devoted to a work on precious stones and physiognomy, "written in honour of Wenzel II, king of the Bohemians" (1266–1305), which was printed at Merseburg in 1473, as the *Lapidarius et Liber de physionomia* of Aristotle. It is an entirely different text from the *Lapidary* of Aristotle published by Julius Ruska at Heidelberg in 1912, which was perhaps the work of a Syrian acquainted with Greek and Persian sources. Our text cites such more recent authorities as Rasis[19] and Albertus Magnus[20], and alludes to mountains of Lombardy, St. Gotthard[21], a castle in Saxony[22], and to the river Saale which flows in Franconia and is called the Christian Saale, and that which descends towards Saxony and is known as the pagan Saale[23].

In both manuscript and printed edition the colophon states that the work is divided into three parts. In the first is treated the *Lapidarius* of Aristotle in the new translation from the Greek with all the other lapidaries and their statements as to the colours, virtues, and place of generation of each stone. In the second part, how the virtues of precious stones are increased and altered according to divers situations, such as wearing them on the finger or in the armpit, or combining them with other things and engraving characters on them. The third part is about physiognomy itself.

Nature is ruled by the stars, but human will is free. The quality of the parents qualifies the semen, unless the constellations rule otherwise. Plato says that when boys are young and moved by the motion of the heavens and not by reason, it should be noted to what they are most inclined[24] and in what they most delight. But they can be drawn contrary to their natures by the virtues of herbs, of parts of animals, and especially by the virtues of precious stones. These last operate in ligatures and suspensions, and when set in true pure metals, not alchemical ones or mixed with herbs and animals. Some gems have virtue set in true gold; others, in pure silver; and so on.

[18] Stadtbibliothek 513, paper octavo, 30 short lines to the page, 58 fols.: "liber de Physionomia in honorem Wenceslai II regis Bohemorum scriptus", opening, "Attendite a falsis prophetis qui veniunt ad vos in vestimentis ovium . . .".

[19] fol. 1v., "Rasis etiam dicit in libro de virtutibus verborum et characterum".

[20] fol. 1r., his *De animalibus* is cited that physiognomy does not impose necessity; 12r., "dicit Albertus in sua scientia minerali".

[21] fol. 11v., "in partibus seu montanis Lombardie citra montem sancti Godhardi quod vulgariter dicitur Elueling".

[22] fol. 13v.

[23] fol. 17r., "in Sala que fluit in Franconia que Sala Christiana dicitur et in Sala que descendit versus Saxoniam que Sala paganica nuncupatur".

[24] In the edition of 1473, *inclinati*; in Berne 513, fol. 1v., *informati*.

Both stones and metals lose their virtues with the lapse of time, like the *orphanus* in the imperial crown, which once shone in the dark. Thirdly, they operate when engraved with images and characters. In judgments of physiognomy sex should further be considered.

The names of 39 gems are listed at fol. 3r.–v., before and after which we are told that the work is in honour and perpetual memory of Wenzel II[25]. The first chapter on jasper then begins, and thirty leaves are filled with the marvellous properties of gems. Aristotle is cited "in his Lapidary"[26], and in the book on the nature of serpents, as to the snake which stole the gem from Alexander's belt, while he was in swimming[27]. Conversely, a toad disgorged a gem upon the cloak of a sleeping soldier near the aforesaid castle in Saxony[28].

Such local allusions at first suggest that the passages in which they occur are taken from Albertus Magnus, but I have failed to find them in his *Liber mineralium* and others of his works on nature. Our writer presently states that he has learned "from a curious experimenter and truthful man", that near the city of Gollaria (?) there is a small stream "in whose bed naught but jacinths are found"[29].

Some very marvellous properties are claimed for stones, and the fact, as our author would have it, that some basilisks are found having precious stones, leads him to close the first part of the work, which occupies more than half thereof, with a digression on the three kinds of basilisks[30]. That hatched from a cock's egg is the most horrible. It kills a man by a glance and is a small animal about the size of a chicken. Its feet and head are like a rooster's, but its beak is like the mouth of a toad. It does not have wings like a fowl, but talons which to some extent serve it as wings. It lacks the long feathers of wings but has small short plumes about neck, head and back, and two short curved pinions on its tail. And plumes or pinions are all alike of the colour of clay or of a toad. And its underside is all bare like a toad.

[25] fol. 2v., "in dei honorem omnipotentis et gloriam et perpetuam memoriam virtuosi Wenceslai secundi regis Bohemorum principis gloriosissimi"; 3v., "In ipsius enim laudem honorem ac perpetuam memoriam hic liber extitit compilatus".

[26] fol. 12r., "dicit autem Aristoteles in suo Lapidario".

[27] fol. 13r. This is also told in Peter of Abano's *De venenis*; see my *History of Magic and Experimental Science*, II, 265–66. It is found earlier in Albertus Magnus, Liber II Mineralium, Tract. II, cap. xiv.

[28] fol. 13v.

[29] fol. 17r., continuing the passage quoted above in note 23, "Intelleximus etiam ab experimentatore curioso et viro veridico quod est in Harlono (*Hartone* in the printed edition of 1473) versus civitatem Gollariam quidam parvulus rivulus seu flumens (' *fluvius* in 1473 ed.) in cuius fundo nichil aliud quam iacinti reperiuntur".

[30] Similarly Albertus told of an experiment with toad and emerald in his book on plants: *De veget. et plantis*, VI, ii, 1.

Such a basilisk was once killed in Saxony by a weasel in the place called Hall. It is also killed by a mirror, preferably of steel, for when it looks in the mirror, the venomous spirit from its eyes is reflected and kills the basilisk itself. "Quomodo autem et quare hoc contingat, de hoc nichil ad presens".

The second type of basilisk is produced artificially and is more or less noxious according as the herbs and other things from which it is produced are more or less poisonous. "And they are of diverse forms according to the divers constituents from which they are artificially produced".

The third kind of basilisk is generated in mines. It, too, has feet and head like a fowl, very beautiful eyes like the bird called *herodius*, and a serpentine tail. It is so very black that it almost shines, and it has wings like the first kind of basilisk except that they are black. It also has numerous small veins "ad colorem auri in nigredine declinantes". These basilisks are not so harmful as the others, and their water and oil are very useful in alchemy. Further, they sometimes have gems in their heads, one in the brain, another in the right eye, and a third in the left. These stones operate in general against swellings and poison, and that located in the brain in especial brings honours, friendship and victory. That found in the right eye is especially good against fire risks and wins the love of women. That in the left eye works against dangers of waters, giving victories there, and makes its wearer amiable and pleasing to all.

The first kind has the special name *baselistes*; the second, *victoristes*; the third, *undastes*. One of the last variety was found by men digging a moat about the castle called Hardensten in the east. And many say such animals are found in those mountains. But their utility, especially when they contain the aforesaid gems, is unknown to the native inhabitants[31].

In the second part, too, the marvels are not limited to stones. Thus we are told that, if the milk of a woman or other mammal is emitted from the breast on to a coal fire and covered with live coals, immediately she ceases to have milk, no matter how abundant it had been[32]. Indeed, the plan of this part involves treating the parts of animals, the virtues of herbs, combinations of stones and metals[33], and various combinations of the three foregoing.

The third part on physiognomy (*De phisonomia*) occupies fols. 47r.–58r.

[31] Berne 513, fols. 34v.–35v.

[32] fol. 45r.

[33] At fols. 41v., 42r. and 43r. respectively.

DR. JOHNSON'S FIRST PUBLISHED WORK?

By F. W. Gibbs*

This anniversary year of Samuel Johnson's birth seems an appropriate time to put forward a suggestion which, though it cannot be directly proven, has stood up to several years of scrutiny. If acceptable, it will help to fill a gap in our knowledge of Johnson's early activities. At worst, the facts presented will help to illustrate Johnson's interest in science, and particularly chemistry.

The suggestion is that Johnson, at the age of 22, was the author of one of the rarest pieces in the literature of chemistry—the first eight sheets of a translation from the Latin of Boerhaave's *Elementa Chemiae*.

The title-page of the work reads:

> Elements of Chemistry. Being the Annual Lectures of Hermann Boerhaave, M.D. In Two Volumes. Illustrated with several Copper Plates. Englished by a Gentleman of the University of *Oxford*. Numb. I. London: J. Clarke and S. Austen; sold by J. Roberts. (Price 1s. 6d.)

Copies of the translation are to be seen in that valuable collection of 18th-century literature in the library of the Medical Society of London and at the British Museum; but I cannot find any others. The translation bears no date but, as shown recently[1], it was published on 10 January, 1732. A notice to purchasers says that it had been translated from the edition of Boerhaave's *Elementa Chemiae* "just publish'd at Leiden (each Exemplar being signed with his own Hand) . . .". This was the edition of I. Severinus, dated 1732, and copies were in circulation in October, 1731[2]. These dates are important, for they narrow down the time when the translation was made, almost to a certainty, to November or December, 1731.

John Clarke and Stephen Austen were reputable publishers dealing principally with legal and theological works[3], and it is not known how they became

* The Royal Institute of Chemistry, London. Written September, 1959.

[1] Gibbs, "Boerhaave's Chemical Writings", *Ambix*, 1958, **6** (3), 124.

[2] *Ibid.*, 131 (Item 4), 122.

[3] H. R. Plomer *et al.*, *A Dictionary of the Printers and Booksellers . . . from* 1726 *to* 1775, London (Bibliographical Society), 1932, 10, 52. Clarke was also one of the publishers of Dallowe's translation (1735), and it has been suggested that the earlier partial translation was also the work of Dallowe. But a comparison of styles (*see* below) shows that this is impossible.

interested in this project. James Roberts, the bookseller of Warwick Lane, is known to have been the publisher of one of Johnson's early pieces, his *Life of Savage*, which appeared in 1744 after many delays[4]. It had no author's name on the title-page, for Johnson was still just an anonymous compiler. It is also of interest that Roberts was the bookseller who handled the works of Johnson's schoolfellow Robert James, including the *Medicinal Dictionary* (1743–45), to which Johnson contributed the account of Boerhaave (from the life he wrote for the *Gentleman's Magazine* in 1739) and other articles[5].

Although the translation of the *Elements of Chemistry* was anonymous, the author's description of himself—a Gentleman of the University of Oxford—fits Johnson perfectly, for he had recently been forced to leave the university without a degree[6]. It appears that the translation was unknown to contemporary writers, or disregarded, and no reference to it has been found in any 18th-century scientific book.

Despite the attempts of many bibliophiles who have endeavoured to trace Johnson's writings before 1739, the only separate work of consequence that has survived from that period is his abridged translation of Le Grand's French edition of Lobo's *Voyage to Abyssinia* (1735) which, as is well known, was printed in Birmingham, though it bore London on the title-page. It is common knowledge, too, that Johnson contributed essays to early numbers of *The Birmingham Journal*, brought out in 1732 by his friend Thomas Warren (who later saw to the printing of the *Voyage to Abyssinia*), but not a single copy of the issues believed to have contained them has survived. It is likewise known that in 1738 Johnson issued proposals to translate part of Father Paul Sarpi's *History of the Council of Trent*[7], but Boswell informs us that it stopped after a few sheets had been printed, and he was not aware of the survival of any copy in 1791. Some of Johnson's other projects, such as his proposal to translate the poems of Angelo Politiano, came to nothing through lack of support. As so little of Johnson's early work has survived, for so many of

[4] R. Lynam (Ed.), *The Works of Samuel Johnson*, London, 1825, iv, 31.

[5] For details, see A. T. Hazen, *Bull. Inst. Hist. Med.*, 1936, **4**, 455; J. L. Clifford, *Young Samuel Johnson*, London, 1955, 255–6.

[6] J. L. Clifford, *op. cit.*, has given a full account of Johnson's early life, with informative notes and references. *See* Chapter VII, "Oxford". It is an odd fact that the use of the word "Gentleman" by Johnson's father, Michael, is discussed by Boswell in the opening chapters of his *Life of Samuel Johnson*.

[7] Even in his *Life of Sarpi* (*Gent. Mag.* 1738, **8**, 581–2), which had little connexion with science, Johnson contrived to mention chemistry. Describing the extent of Sarpi's learning, he referred to the languages and other branches of knowledge with which he was familiar, and ended with the revealing phrase "and chemistry itself". Sarpi "conversed with Chemists upon the Analysis of Metals, not as a superficial Enquirer, but as a complete Master".

his projects went awry, and as he was an anonymous writer for a considerable period, it is not surprising that a direct proof of the suggestion now being made cannot be offered.

To make a closer examination, we may begin by asking whether Johnson was in a position to undertake the translation. He had no employment at that time, so far as is known. J. L. Clifford has described his situation in some detail[8], and says that about the end of October, 1731, there occurred "one of the best-known events in Johnson's early life", when he refused to go from Lichfield to man the bookstall of his father, Michael, at Uttoxeter market:

> One day, when Michael was confined to his bed with illness, he asked his eldest son to go to Uttoxeter to visit the market and attend the stall in his place. Because of pride, Sam refused. To sell wares in the open market-place seemed below the dignity of an Oxford man. He stubbornly remained deaf to his father's request, and the incident was closed. But his rigorous conscience never allowed him to forget; the refusal remained at the back of his mind as a constant goad to his sense of guilt. Finally, fifty years afterwards, he felt an overpowering desire to expiate this act of filial disobedience, and one day slipped away from his friends in Lichfield, drove to Uttoxeter, and stood bare-headed in the market-place at the spot where his father's stall had been, "exposed to the sneers of the standers-by, and the inclemency of the weather".

Michael died in December. Even if the dating of this incident is incorrect —and it is by no means proven—the fact remains that the family was in an almost desperate situation in the autumn of 1731 and that Samuel needed some way of rising from his state of dejection and of showing that he was indeed a gentleman of the University of Oxford and not a market-place vendor of books and patent remedies (in which his father also dealt). Samuel's attitude had changed little since he left Pembroke College, where he had appeared "brazenly self-confident". As he said later: "I thought to fight my way by my literature and my wit; so I disregarded all power and all authority". Oliver Edwards, a fellow-student at Oxford, said that he was "delicate in language" and the students all feared him; he would not even let them say "prodigious"[9]. This does not quite fit our picture of the later Johnson, but some toughening of his character and of his language resulted from his hard struggle in London to establish a reputation.

Other important questions that must be asked are these: Did Johnson have, or could he have obtained, the necessary books? What is known of his style

[8] See Chapter VIII, "Dejection and Indolence", in Clifford, *op. cit.*, 124–30.

[9] G. B. Hill (Ed.), *Boswell's Life of Johnson*, revised and enlarged by L. F. Powell, Oxford, 1936–50, i, 73–4; iii, 303. He nevertheless used it himself. *See* below.

or his literary models in those early days? What did Johnson know of chemistry or of Boerhaave?

When he went up to Oxford in 1728, Johnson had a large library for a youth in his restricted circumstances, and it is clear that Michael, being a bookseller, indulged his son in the only way open to him. Samuel took more than eighty books with him to the university, and a list of these has been preserved[10]. Not one of them has any bearing on chemistry, but this is scarcely surprising, for his aim was to read the classics and to excel in literature. On the other hand, though these books were certainly well selected for the work in hand, there is no reason to suppose that they were all he had. Several of the books he then owned were still in his library when it was sold after his death[11], and it seems likely that a fair proportion of those that had been published during the later 1720's and up to 1737, when he moved to London, were obtained through his family.

Did Johnson have the necessary books in order to carry out the translation? When questions like this need an answer, the deficiencies of the catalogue issued by Christie in 1785 become painfully clear. The books were not listed separately but often in parcels or lots, and several of the books we know he used are not mentioned individually. Nevertheless, the catalogue reveals not only that Johnson possessed Boerhaave's *Elementa Chemiae*, published at Leyden and dated 1732, but that he had *two* copies[12]. This can only mean that he had an unusual interest in the work.

Though the 1727 edition of Boerhaave's chemistry is not mentioned in the catalogue, Johnson could not have failed to know of it. This was the unauthorized text translated by "Peter Shaw M.D. and Ephraim Chambers, Gent."[13]. There is no evidence that he ever used or referred to any English edition later than this. Another favourite book of Johnson's, much used for the *Dictionary*, but not mentioned in the catalogue, was John Arbuthnot's *Essay concerning the Nature of Aliments*, published in 1731 just before the *Elementa Chemiae*. This may not seem relevant until it is realized that the preface to the book contained a most remarkable acknowledgment: "The most part of it was wrote in a Situation where I had no Assistance, except from Extracts out of some imperfect Editions of the Works of the most learned and industrious Boerhaave, and from a very excellent Edition of his Chymistry

[10] For details, *see* A. L. Reade, *Johnsonian Gleanings*, London, 1909, etc., v, 27, 213.

[11] *Cf.* ref. 9 with *A Catalogue of the valuable Library of Books, of the late learned Samuel Johnson . . . which will be sold . . . By Mr. Christie, At his Great Room in Pall Mall, On Wednesday, February* 16, 1785, *and three following days* (copy in British Museum; also reprinted in facsimile by Unwin Bros., London, 1892).

[12] *Ibid.*, p. 6, Lot 80 (included Elementa Chemiae, a Herm. Boerhave, 2t. L.B. 1732 4to); p. 19, Lot 398 (included Elementa Chemiae, a Boerhave, L.B. 1732 4to).

[13] Gibbs, *op. cit.*, 131, Item 3.

by Dr. *Shaw*, and Mr. *Chambers*. This I am oblig'd to say once for all, to save myself the Trouble of perpetual Quotations". Thus in effect several of the medical and chemical terms in Johnson's *Dictionary* were defined from the works of Boerhaave as recorded by Shaw, Chambers and Arbuthnot.

Shaw, who like Johnson was born and spent his early years in Lichfield, is not mentioned by Boswell, but it is likely that Johnson would have been interested in a fellow-townsman distinguished for his literary activities. The others, Chambers and Arbuthnot, are shown by Boswell (though he found it impossible to believe) to have played an even more significant part in forming Johnson's literary character than the above facts alone might suggest. In later life Johnson claimed that he had taken as his models Sir William Temple (1628–99), the celebrated statesman, essayist and writer of memoirs, and Ephraim Chambers[14] (1680–1740), who published his *Cyclopaedia, or an Universal Dictionary of Arts and Sciences* in 1728, the year after his collaboration with Shaw on the translation of Boerhaave's chemistry lectures. In the list of subscribers to that expensive work occurs the name of "Mr. Michael Johnson of Litchfield". Later Samuel acquired a copy of the fourth edition of 1741. If, as he said, he was particularly impressed with the style of Chambers's printed proposals for the *Cyclopaedia*, the date of his interest could well have been the crucial period 1727–28, just before he went to Oxford. Johnson may well have seen also the proposals for "Shaw and Chambers", which would have reached the booksellers in advance. This, too, appears to have been the work of Chambers, and it contains some fine passages[15]. Johnson's mention of having adopted Chambers as one of his models seems to be very positive evidence of his interest in science even in his youth (at the age of 18 or 19).

Boswell also tells us that Johnson maintained what, at first sight, might seem a surprising contention—that John Arbuthnot (1667–1735) was the best writer in the reign of Queen Anne, whose physician he became in 1705. Johnson's reasons are interesting. "He was the most universal genius, being an excellent physician, a man of deep learning, and a man of much humour"[16]. In his life of Pope he gave a more penetrating view[17].

> Arbuthnot was a man of great comprehension, skilful in his profession, versed in the sciences, acquainted with ancient literature, and able to animate his mass of knowledge by a bright and active imagination; a scholar of great brilliancy of wit; a wit, who, in the crowd of life, retained and discovered a noble ardour of religious zeal.

[14] Powell's *Boswell*, i, 218–9.

[15] Imperfect copy at the Guildhall Library. Gibbs, *op. cit.*, 121. Several of Johnson's commentators, not being interested in science, have failed to appreciate the importance of Chambers's works in 1727–28 and have assumed that this refers to a much later period, after Johnson had moved to London.

[16] Powell's *Boswell*, i, 425.

[17] Lynam's *Works*, iv, 224.

Again, in 1775, when Boswell asked for help in preparing his case against Dr. Memis of Aberdeen, Johnson mentioned three medical men whom he considered pre-eminent in their profession. One clearly had to be Cullen, for the case was being heard in Scotland; the others came easily to his tongue—Boerhaave and Arbuthnot—not everyone's selection, but typically Johnson's[18].

We can therefore say, with what amounts almost to certainty, that among the influences that helped to form Johnson as a writer were the works of Chambers and Arbuthnot, and that he was probably familiar with the most important of them in 1731.

The definition of "Chymistry" in Johnson's *Dictionary* (he accepted and used both spellings) was stated to be Boerhaave's. It was in fact taken from the 1727 edition of Boerhaave's chemistry lectures as adapted by Chambers for the article "Chymistry" ("or more properly Chemistry") in his *Cyclopaedia* of 1728. What is also surprising is that the definition given by the "Gentleman of the University of Oxford" (who also used the less common but more proper spelling, Chemistry) is a partial translation, quite different from the later ones of Dallowe and Shaw; it was also rather more straightforward than the original; but it was obviously adapted from the 1727 edition. This is demonstrated below, the words taken from "Shaw and Chambers" being italicized.

Shaw and Chambers, p. 51 (1727).

> Chemistry is an Art, whereby sensible bodies contain'd in vessels, (or at least capable of being contained therein and render'd sensible;) are so chang'd, by means of certain instruments, as especially fire, that their several powers, and virtues are thereby discover'd; with a view to the uses of medicine, natural philosophy, and other arts and occasions of life.

Gentleman of Oxford, p. 29 (1732).

> *Chemistry is an Art whereby sensible bodies contained in Vessels, are so chang'd by means of* proper *instruments, that their* certain and particular effects *are thereby discovered*, and the causes of those effects explain'd from the effects themselves, to the service and improvements of various Arts.

From this comparison we can say that the "Gentleman of the University of Oxford" had a copy of "Shaw and Chambers" at his side, but quickly decided that the new definition in Boerhaave's genuine text varied a great deal from the earlier version. That he also abridged it can be seen by comparing it with the more accurate, though more complicated, translations of Dallowe and Shaw. Our "Gentleman", apparently feeling less confident with the subject matter

[18] Powell's *Boswell*, ii, 372.

than the others, finished up with half from the old version and half from the new. No experienced writer would have risked detection in this way.

Dallowe, i, p. 19 (1735).

> Chemistry is an Art, that teaches us how to perform certain physical operations, by which bodies that are discernible by the senses, or that may be rendered so, and that are capable of being contained in vessels, may by suitable instruments be so changed, that particular determin'd effects may be thence produced, and the causes of those effects understood by the effects themselves, to the manifold improvement of various Arts.

Shaw, i, p. 65 (1741).

> Chemistry is an art which teaches the manner of performing certain physical Operations, whereby bodies cognizable to the senses, or capable of being render'd cognizable, and of being contain'd in vessels, are so changed, by means of proper instruments, as to produce certain determined effects; and at the same time discover the causes thereof; for the service of various arts.

We now come to the most difficult part of the task—to show if possible that the *Elements of Chemistry* bears the stamp of Johnson's style. The absence of any other works of his written in 1731 only enhances the difficulty. The nearest we can get is his letter to Gregory Hickman dated 30 October, 1731 —the earliest of his letters to have survived[19]. Perhaps the best course is to adopt Boswell's procedure when describing Johnson's account of Lobo's *Voyage to Abyssinia*, the first sizeable work that Johnson completed, though not without pressure from his sponsor.

Of this translation Boswell said:[20] "there is in the work itself no vestige of the translator's own style; for the language of translation being adapted to the thoughts of another person, insensibly follows their cast, and as it were runs into a mould that is ready prepared". Boswell was, if anything, too kind, for he does not say that the work shows how much Johnson still had to learn in his profession of writer. Judging by the anecdote from his Oxford days it would be expected that he did not approve "prodigious"; yet he wrote, for example, "prodigious numbers of his men" (p. 77) and "a prodigious

[19] *Ibid.*, i, 78. G. B. Hill (Ed.), *Letters of Samuel Johnson*, Oxford, 1892, i, 1.

[20] Powell's *Boswell*, i, 87. Boswell again referred to the book in conversation with Johnson on 31 March, 1776. "I called on him, and showed him, as a curiosity which I had discovered, his 'Translation of Lobo's Account of Abyssinia', which Sir John Pringle had lent me, it being then little known as one of his works. He said, 'Take no notice of it', or 'don't talk of it'. He seemed to think it beneath him, though done at six-and-twenty. I said to him, 'Your style, Sir, is much improved since you translated this'. He answered, with a sort of triumphant smile, 'Sir, I hope it is' ".

Slaughter" (p. 80). One of his paragraphs (p. 78) begins: "Nor did the Resentment of *Mahomet* end here, he divided his Body into Quarters, and sent them to different Places". Another sentence (p. 76) reads: "They see new troops arrive every Day at the Enemies Camp, and their small number grew less continually, their Friends at *Mazna* could not join them, they know not how to procure Provisions, and could put no confidence in the *Abyssins*". Perhaps some of Johnson's admirers would be disappointed with p. 24, where expressions such as "Neither of these Accounts are satisfactory" will be found.

It seems important that these things should be pointed out, as it would be easy to quote passages from the main text of the *Elements of Chemistry* to show that they reveal "no vestige of the translator's own style". Anything that appears to be of inferior quality in this can be matched with something of similar quality in the *Voyage to Abyssinia*.

Boswell, however, went on to say: "But, in the Preface, the Johnsonian style begins to appear; and though use had not yet taught his wing a permanent and equable flight, there are parts of it which exhibit his best manner in full vigour[21].

Similar words might be used of the dedicatory letter in the *Elements of Chemistry*, though to some the Johnsonian style may be less clear than in the later work. If this should be so, there are two main reasons that might be adduced: the dedicatory letter was not an original composition, but a translation, and Johnson (if he had been the translator) would have had three years less experience than when he wrote the *Voyage to Abyssinia*. Boerhaave dedicated the work to his brother, James. There is nothing particularly distinguished about the opening sentences[22], but the translation quickly warms to the theme when mentioning the many days and nights the two brothers had spent in their youth carrying out experiments in chemistry, taking no account of the danger they sometimes faced together. The translation goes on:

> You were at that time designed for Physick, and I for Divinity: But Providence would have it otherwise; and whilst You attended at

[21] *Ibid.*, i, 88. The dedication may even owe something to the thoughts in Boerhaave's dedicatory letter (*see* end of following paragraph). In the 1731 translation we find: "I intreat You to accept it, as . . . a Publick Token . . . of . . . Affection"; the 1735 dedication ends: "I entreat your Acceptance of it, as a Token of . . . Affection". The coincidence is remarkable.

[22] "As I could not any ways avoid publishing the Book I now address to You, I was obliged in my old Age to review many of the Labours of my Youth, not without a sort of Amazement, as often as I reflected on the Variety of the Operations, and the mighty and terrible Dangers that attended the Execution of them. I cannot but remember, and with great Pleasure and Gratitude acknowledge the equal part You bore throughout this whole Exercise. Nor do I believe that You yourself can, but with some degree of Satisfaction, call to mind the many Days and Nights we spent together in a chemical Examination of Natural Bodies".

> the Altars of the Deity, recommending his Precepts with a Simplicity of Speech and a Sanctity of Manners; I, unequal to so arduous a Task, contented myself to employ my weaker Talents in the healing Art. You have an undoubted Claim to the Work You had so large a Share in; and therefore I intreat You to accept it, as what I sincerely intend, a Publick Token, and a standing Monument of brotherly Candour and Affection. I have ever esteemed it my greatest good Fortune, to have been bless'd in a Brother whose Principles and Actions have rendered him worthy of the great office to which he was called, and whose only Ambition is to conciliate Men to God.

This, in my opinion, is fine writing, far above the level of any language to be found in a chemistry text at that time. The translations of Dallowe and of Shaw are more faithful, but they contain none of this nobility of expression, part of which indeed seems to have been the translator's own creation. To make this point clearer, we may compare their final sentences.

Dallowe.

> If in my Province, I have been so happy likewise to behave in such a manner, as to meet with your Approbation, I shall have wherein to rejoice. Adieu; and whilst you are now and then amusing yourself with Things of this Nature, don't forget those joint-labours we were formerly so agreeably engaged in.

Shaw.

> If I, too, have acted my part in a manner which may give you any pleasure in the reflection, I shall be doubly satisfied. Adieu Brother, and while you run over the ensuing pages, remember what pleasures we have formerly reap'd in these pursuits.

Gentleman of Oxford.

> Happy for me if I have so acquitted myself in my own Province, as not to have deserved Your Censure! Adieu: And as often as a little Leisure shall permit You to take this Book in hand, remember that after all the Toil we underwent together, we never once thought it tedious.

Who, other than Johnson, among those interested in Boerhaave's writings, could have improved the original in translating it? The last thought—"we never once thought it tedious"—is the translator's own. We cannot help recalling Boswell's comment that, in his Life of Boerhaave, Johnson discovers that love of chemistry which never forsook him[23]. It also reminds us of Johnson's portrait of Mr. Sober—a self-portrait, so he told Mrs. Thrale[24]—

[23] Powell's *Boswell*, i, 140.

[24] Lynam's *Works*, ii, 476 (*The Idler*, No. 31, 18 November, 1758); Powell's *Boswell*, iii, 398; G. B. Hill (Ed.), *Johnsonian Miscellanies*, 1897, i, 48 (from H. L. Piozzi's *Anecdotes*, 1786).

who daily turned to chemistry to alleviate the misery of those "tiresome intervals" in the day when he was alone. "He draws oils and waters, and essences and spirits, which he knows to be of no use; sits and counts the drops, as they come from his retort, and forgets that, whilst a drop is falling, a moment flies away". Again: "He has a small furnace . . . which has long been the solace of his life". It is difficult to resist the feeling that the translation had been made for the sake of the dedicatory letter and that the translator had never intended to "English" the whole of this voluminous treatise.

It would be pleasant to end on this note, but there may be objections against accepting this as Johnson's work, especially as his early writings are not familiar to many. Perhaps the most jarring sounds in the dedicatory letter are: "any ways", "sort of Amazement", "mighty and terrible Dangers" in the first sentences[22], and possibly "underwent" near the end. These can most easily be answered in the reverse order. "Underwent" occurs in the first sentence on the contents page of the *Voyage to Abyssinia*, in which also there are many examples of amazement and dangers of various kinds, with such words as horrid, dreadful and terrible used in their semi-poetic sense. Is "mighty and terrible Dangers" an early example of Johnson's little fishes talking like whales? Similarly "sort of Amazement" can be matched with "two sorts of Hermits" in the later work (p. 395). In his *Dictionary* Johnson declared "any ways" to be corrupt, but we do not know why or when he decided that this was so. Under "Way" he gave a Biblical quotation (*Numb.* xxx, 15)[25] illustrating the use of "any ways". The fact that he disapproved the expression in 1755 does not exclude the possibility that he might have used it twenty-four years earlier. Against "Nowise" Johnson wrote: "This is commonly spoken and written by ignorant barbarians, *noways*!" Was this trick of speech something for which Johnson himself had been twitted? No explanation can be found at a serious level for, as Campbell pointed out[26], it was "strictly conformable" to Johnson's own principles. Campbell wrote: "These ignorant barbarians . . . are only Pope, and Swift, and Addison, and Locke, and several others of our most eminent writers".

[25] While not wishing to make too much of coincidences, it should perhaps be mentioned that the translator of the *Elements of Chemistry* called his first eight sheets 'Numb. 1', not 'No. 1' (*see* title).

[26] G. Campbell, *The Philosophy of Rhetorick*, London, 1776, i, 371. It is characteristic of the period that science and letters went hand in hand. Thus Campbell often referred to Joseph Priestley, in addition to Johnson, as an authority on English, though he frequently disagreed with both. Priestley's chief work in this field was his *Theory of Language and Universal Grammar*, Warrington, 1772. His "Observations for the Use of Proficients in the Language" were included in his *English Grammar*, London, 1772, which had been first printed in 1761 for the use of his school at Nantwich.

Appendix

If the identity of Johnson and the Gentleman of the University of Oxford is accepted, it is worth considering whether he was not also the translator of another publication, namely Boerhaave's experiments on mercury. This was printed for the same James Roberts and is now very scarce. The title-page reads:

> Some Experiments concerning Mercury. By J. H. Boerhaave, Professor of Physick at Leyden. Translated from the Latin, communicated by the Author to the Royal Society. London: Printed for J. Roberts, near the Oxford-Arms, in Warwick-Lane. MDCCXXXIV. Half-title: Some Experiments concerning Mercury. Price One Shilling.

Copies of this piece are to be found in the libraries of the Medical Society of London and the Patent Office. It seems, however, that the authorship of this translation would be even more difficult to establish than that of the *Elements of Chemistry*. It might be thought that Johnson would not have written such a title, but considering his interest in Arbuthnot's *Essays concerning the Nature of Aliments*, and his approval of this use of "concerning" in the *Dictionary*, this cannot be a serious objection. The appearance of "J" (presumably standing for *Jonkheer*) before the name H. Boerhaave is, I believe, unique among the many hundred editions of his works, and suggests that the author was not one of the usual translators of Boerhaave's writings.

A SURVEY OF ALCHEMICAL AND HERMETIC SYMBOLISM

By H. J. Sheppard*

For the reader interested in symbolism there can be no more profitable study than the alchemical texts which emanated from western Europe during and immediately after the Renaissance. Apart from the conventional signs derived from earlier texts, they contain a wealth of complex pictorial representations intended to symbolize the methods and aims of the so-called Hermetic Art in such a fashion that the traditional secrets were concealed from all but initiates.

Today, when knowledge is more widely spread, the apparent meanings of the ideas and processes are more easily recognizable by anyone conversant with the fields from which the symbols were drawn. The danger arising from their interpretation would now appear to have been slight, at any rate, from a practical point of view, for the materials and the methods suggested are themselves sufficiently ambiguous or unreal to be considered in any but an esoteric sense; beneath the mask of symbols there lay still hidden the true nature and the methods of alchemy.

The purpose of the present study, however, is not to consider the interpretation of the alchemical process, but rather to decide how alchemical and Hermetic "symbols" fit into a scheme, or classification, which may be derived from a consideration of symbolism in general. This must, naturally, take cognizance of the sources and of the mechanisms by which the symbols are derived from these sources, though to do this fully would require considerably more space than is available here. In the main, information relating to sources and selection processes will be limited to references to the more important works which may be conveniently consulted.

The Interpreters of Symbolism

Until early in this century the few serious works[1] which had been written on the subject of symbolism were confined to the ancient religions. A few less-critical studies preserved the traditional interpretations of alchemical symbolism without themselves adding much of value: the *Dictionnaire Hermétique*, Pernety's *Dictionnaire Mytho-Hermétique*, the *Théories et Symboles des Alchimistes* of Poisson, and, somewhat later, *Le Symbolisme Hermétique*, by Wirth. Of these books, that of Poisson alone has any value outside the conservation of traditional material. Pernety's enthusiasm led him to see in the

* Warwick School, Warwick.

[1] For details of these and other works mentioned in this section see BIBLIOGRAPHY at the end of this article.

whole of classical and Egyptian mythology nothing but an exegesis of the alchemical process, while Oswald Wirth was concerned mainly with relating the symbols employed in Emblematic Freemasonry to those of alchemy; consequently the use of these works demands the utmost caution.

In 1914 Herbert Silberer, a disciple of Freud, first applied psychology to the study of alchemy, the results being published as *Probleme der Mystik und Ihrer Symbolik*. Here, the production of symbols was attributed to the unconscious mind—a notable advance—though Freudian conceptions naturally laid stress upon sexual significances of the symbols projected, apart from treating alchemy from a personalistic viewpoint rather than basing it upon collective ideas. Silberer's views, too, were largely conditioned by the 19th century American writer, Ethan A. Hitchcock, whose book, *Remarks upon Alchemy and the Alchemists* (1857), portrayed the process as a spiritual technique for the perfection of man's nature.

Significantly, it is to the depth psychology of C. G. Jung that further ideas on the nature of alchemical symbols were due. Struck by the many resemblances between the dream symbols produced by psychotic patients and the symbolism of alchemy, Jung devoted himself to a study of alchemy, which, after a period of some years, resulted in the publication of several works in which the alchemical *opus* is depicted as a psychic attempt at "cosmic redemption"—an extension, as it were, of the redemption of the individual, which was the central task of Christianity. Of the importance which Jung attached to symbols more will be said later.

The psychological approach has coloured most recent serious studies on symbolism; an essay by Mircea Eliade: *Images et Symboles* (1952), surveys a wide range of magico-religious symbolism from a variety of aspects—anthropological, ethnological, psychological, etc.—in an attempt to rank it as a "new humanism." An admirable work, it unfortunately offers little of immediate value for the study of alchemical symbolism, nor is it directly concerned with the general classification of symbols. For the latter purpose an interesting alternative to the psychological treatment is proposed by René Alleau in *De la Nature des Symboles* (1958), the substance of which will be outlined in the next section.

In addition to the books and authors mentioned above, there are certain other studies of considerable value, such as those of Gessman, Zuretti and Lüdy; they are listed in the bibliography at the end, together with further details of works already referred to.

The Nature and Function of Symbols

The term SYMBOL naturally evokes a number of words with which it has affinities; Fowler lists some thirty-two, including EMBLEM and SIGN. In all

these there occurs the idea of a representation by virtue of the possession of analogous qualities or by association in fact or thought—and one is thus led to include further terms of importance in the field of literal symbolism, terms which likewise imply comparison: the figures of speech SIMILE, METAPHOR and ALLEGORY, all of which may be applied to alchemical symbolism.

In the definitions of these terms the important difference lies in the presence or absence of a connecting link to complete the comparison. With the SIMILE two subjects are kept distinct in both the expression and the thought; a conscious comparison is expressed in the form "X is like Y".

In the METAPHOR the subjects are kept distinct in the thought but not in the expression; a comparison is insinuated but not expressed. The conscious link disappears with the literal intention, so that the words in which the comparison is implied must not be taken literally but regarded in a figurative sense. ALLEGORY, which includes FABLE and PARABLE, is, of course, a protracted metaphor, in which one subject (not formally mentioned) is represented by another in some way analogous to it.

With the SYMBOL, too, the link has disappeared; the object referred to conveys all the meanings which its nature allows it to, that is, no external associations are required to make its meaning clear.

Literary usage of these terms shows, then, the differences between the figures of speech but regards as synonymous the words SIGN and SYMBOL. Obviously, any difference between these two will depend upon semantic values, being based either upon psychological considerations or upon some newly-established convention, both of which will now be considered.

Silberer defined the SYMBOL in Freudian terms as a pictorial representation penetrating the conscious and suggesting some idea content, wish content, etc., which is determined by and impelled by the unconscious.[2] This in itself implies the mechanism of production, with no clear distinction drawn between SYMBOL and SIGN. A more explicit statement is met with in Jung: a SIGN is a substitute for, or a representation of, the real thing, whereas a SYMBOL carries a wider meaning and expresses a fact which cannot be formulated more exactly.[3] It is thus, in a sense, an extended metaphor—or in Jung's terms, "a libidinal parable", because it transforms energy (libidinal) by drawing it over into another form than the original[4].

Thus formed, it has at the same time both expressive and impressive characters, expressing on the one hand internal psychic happenings pictorially, and on the other hand—after having been transformed into images, or having

[2] H. Silberer, *Probleme der Mystik und ihrer Symbolik*, Part 3, pp. 149 ff.
[3] F. Fordham, *An Introduction to Jung's Psychology*, London (Pelican Books), 1953, p. 20.
[4] J. Jacobi, *The Psychology of C. G. Jung*, London, 1951, pp. 111 ff. Ample references to, with quotations from, the original works of Jung are provided.

been embodied, as it were, in an imaginary material—influencing through their meaningful content these same happenings, thus furthering the flow of the psychological processes.

It follows that SYMBOLS are never produced consciously; they emerge from the unconscious in much the same way as do revelations or intuitions. Natural events can be portrayed symbolically just as well as internal psychological processes: for example, the diurnal motion of the sun can represent to the primitive mind the concrete, external, natural event, whereas to the psychologically disposed modern man it depicts a similar equally regular happening in his internal world.

Considered psychologically, then, a SYMBOL may be regarded as possessing dual content. Its rational component is made comprehensible to consciousness (compare the outward form expressed in METAPHOR or ALLEGORY), while its irrational component (or "inner" meaning) can only be grasped by the feelings.

Whence arise the forms which manifest themselves as the rational components of SYMBOLS? The answer to this is clear from Jung's conception of the unconscious mind as containing a lower layer—the "collective unconscious"—in which is stored a multitude of primordial images, or "archetypes". These archetypes represent the sum total of the manifold responses of man's ancestors to outward happenings, etc., and hence form a mental inheritance which, under certain psychological conditions, may be projected as the imagery of dreams or hallucinations. In short, just as the human body inherits morphological elements, the psyche, as a collective structure, retains inherited primitive components[5].

The establishment of conventions for the classification of symbols will depend upon the basic principles employed. Sherwood Taylor's two categories express the dual natures commonly accredited to alchemical symbols: "the symbolism assumes two divergent characters, that of a notation designed to convey in shortened form an exactly defined meaning, and that of a true symbolism designed to express pictorially or allegorically matters which could be otherwise expressed only at tedious length or not at all."[6] The two types between which he differentiates may be designated "signs" and "symbols" respectively; the latter include all except the simple ideographs having conventionally defined meanings.

The most recent attempt to classify symbols—that of Alleau—has a basis which is in part etymological[7]. "Symbol" is derived from the Greek σύμβολον, a sign by which one knows or infers a thing; it came to include a variety of objects, such as a sign of recognition, a seal, a wedding ring, etc., with all of

[5] *Ibid.*, p. 64.
[6] F. S. Taylor, "Symbols in Greek Alchemical Writings", AMBIX, I, No. 1 (1937), p. 64.
[7] R. Alleau, *De la Nature des Symboles*, Paris, 1958, Part 1, pp. 7 ff.

which it had an apparent affinity. The word implied a relationship between two things having sympathetic natures, and from the dynamic nature of the root verb σύμβαλλειν (to throw or hurl) Alleau sees a suggestion of orientation, or turning towards, in the subject-object relationship. This, he argues, is the explanation of the fact that the ancients tended to restrict the use of σύμβολον to those signs recognized as sacred by religious tradition; the affirmation of a religious belief represented an orientation towards the sacred and hence became "symbolic".

Ancient usage reserved another word for the social mutual links which existed or were employed—σύντεσμα or σύνδεσμα; this denoted a static relationship, capable of description in rational terms, in contrast to the dynamic inference of σύμβολον. Accordingly, Alleau suggests the adoption of the term SYNTHEME (plural SYNTHEMES or SYNTHEMATA) to cover any of the conventional signs by means of which a mutual link is established by men between themselves, or between things, or between an idea and a thing, etc.

Though somewhat specious in derivation, the system is a simple twofold one, under which the whole of alchemical signs and symbols would be regarded as SYNTHEMES, though the term EMBLEM might be applied to those signs which are pictorial and purely representative, i.e. do not denote a link.

Summary of the Methods of Classification Applied to Alchemical Symbols

(*A*) Literary.

(1) SIGN and SYMBOL are synonymous—hence either term covers any alchemical symbol.

(2) FIGURES OF SPEECH: of these, METAPHOR, including ALLEGORY or PARABLE, is applicable either in literal or in pictorial form, e.g. in literal form, the expression "seed" of a metal. In pictorial form, a composition such as *Mutus Liber*[8].

(*B*) Jungian System.

(1) SIGN. This is:

(*a*) a simple representation;

(*b*) a facsimile of the object symbolised, or it may follow an arbitrary convention, e.g. ☉ represents gold;

(*c*) consciously formulated.

[8] *Liber Mutus Alchemiae Mysteria filiis Artis nudis figuris, evidentissimè aperièns*, Altus, La Rochelle, 1677; published in J. J. Manget, *Bibliotheca Chemica Curiosa*, Geneva, 1702, i, *ad finem*. Also reproduced, with introduction by M. Haven, in *Trésor Hermétique*, Lyon, 1914 and 1947.

(2) SYMBOL:

(*a*) simple or composite in form;

(*b*) the object depicted (rational component) cannot be interpreted literally;

(*c*) it is unconsciously formulated and archetypal in origin.

The rational components may take the forms listed under FIGURES OF SPEECH.

(*C*) ALLEAU SYSTEM.

SIGNS comprise:

(1) SYMBOLS—confined exclusively to religious bonds.

(2) SYNTHEMES (or SYNTHEMATA).

(*a*) Abbreviative, i.e. abbreviations for a word to which they are linked in an invariable fashion, e.g. ☉ gold.

(*b*) Didactic, i.e. conventional signs, pictorial and often enigmatical, teaching in concise fashion a certain number of philosophical or scientific beliefs which must not, or cannot, be openly divulged,

e.g. alchemical symbols which do not fall into class (*a*).

THE SOURCES OF THE SIGNS AND SYMBOLS PORTRAYED IN ALCHEMICAL AND HERMETIC TEXTS

Most of the elementary signs are of very early middle eastern origin, with the exception of a few which are Pythagorean. Planetary representations and Greek alchemical signs have been thoroughly discussed by J. R. Partington and by Sherwood Taylor respectively in the first number of this Journal[9].

The figures displayed in most of the complex pictorial representations contained in the Renaissance and immediate post-Renaissance texts are generally drawn from classical mythology. The reader cannot do better than consult the excellent short study of G. Heym[10] for a picture of the contemporary environment responsible for the prolific output of pictorial symbolism of all kinds from the Renaissance onwards. Perhaps the finest source of information on the continuation of the classical tradition through the Middle Ages into the

[9] *Vide* AMBIX, I, No. 1 (1937), "Report of Discussion upon Chemical and Alchemical Symbolism": J. R. Partington, "The Origins of the Planetary Symbols for the Metals", p. 61; F. S. Taylor, *op. cit.*

[10] *Ibid.*, "Some Alchemical Picture Books", pp. 69–75.

Renaissance is afforded by the Warburg Institute, London, in a series of studies by such experts as F. Saxl, E. Panofsky and J. Seznec.

For the psychological interpretation of alchemical symbolism, the works of C. G. Jung, especially *Psychology and Alchemy*, are indispensable.

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UNRECORDED DALTONIANA: TWO LETTERS TO JOHN BOSTOCK AND A PROSPECTUS TO THE "NEW SYSTEM", 1808

By Roy G. Neville*

The *New System of Chemical Philosophy*, 1808–27, of John Dalton (1766–1844) laid the foundations of the first truly workable chemical atomic theory upon which modern theories of the present day were built. This great book, issued in two volumes, is deservedly a classic of chemistry and is now quite rare. The first volume appeared as Part I in June, 1808, and Part II in 1810. Many years later, in 1827, Part I of the second volume appeared; but Part II, which was to have completed the work, was never printed[1]. Having regard to the significance of this book it is surprising that none of the standard works on Dalton[2] records the fact that a printed prospectus to Vol. I, Part I, was distributed by Dalton from his house in Manchester, in May, 1808.

The prospectus is of the greatest rarity and understandably so for, presumably, nobody receiving it in 1808 would have conjectured that it announced the publication of one of the greatest books in the development of chemistry[3]. Thus, recipients of the prospectus would probably have destroyed it upon purchasing the book it advertised, as is the common practice today.

Dalton sent a copy of the prospectus and a covering letter dated 11 June, 1808, to Dr. John Bostock (1773–1846), the famous physician of Liverpool who later renounced medicine to engage full-time in chemical teaching and

* 783 Cereza Drive, Palo Alto, California, U.S.A.

[1] In the preface to Vol. II, Part I, of the *New System*, 1827, page viii, Dalton states: "My present design is to add a second part to this volume, and with that to finish the work. It will consist of the more complex compounds. Acids, and other products of the vegetable kingdom, Salts, &c., will form principal parts. Already I have a stock of experiments on these subjects; but I am not satisfied without exploring this region afresh". Part II to Vol. II never appeared, but it is evident that the chemistry of the animal and vegetable kingdoms had occupied the attention of Dalton for many years, as is shown by his reference to the work of Ellis on vegetation in the second letter quoted in this article.

[2] For example: William Charles Henry, *Memoirs of the Life and Scientific Researches of John Dalton*, London, The Cavendish Society, 1854; Robt. Angus Smith, *Memoir of John Dalton, and History of the Atomic Theory up to his Time*, London, 1856; Henry E. Roscoe and Arthur Harden, *A New View of the Origin of Dalton's Atomic Theory*, London, 1896. In the *Memoirs of the Literary and Philosophical Society of Manchester*, Second Series, Vol. II, London and Manchester, 1813, page 474, there is a "List of Books, &c. Presented to the Society since 1805", wherein is mentioned "Mr. John Dalton. New System of Chemical Philosophy. Vol. 1. Part 1 & 2. Lond. 1808–10. 8°". No mention is made of the prospectus or the circumstances of publication of the *New System*.

[3] A brief announcement of the existence of the prospectus was given by the present writer in *The Book Collector*, 8, 295 (1959).

Manchester, May 12, 1808.

IN THE PRESS,

(And will be ready for publication in June, price Seven Shillings in boards)

PART I.

OF A

NEW SYSTEM

OF

Chemical Philosophy.

BY JOHN DALTON.

THIS work is printed in octavo, and will, when completed, consist of two parts, the second of which, it is hoped, will be published in about twelve months. The first part contains four Plates, illustrative of several new Principles developed in the work, and is divided into three Chapters: — The first chapter is on Heat or Caloric; it is subdivided into nine Sections—1st. On Temperature and the instruments for measuring it; — 2d. On Expansion by Heat; — 3d. On the specific Heat of Bodies; — 4th. On the Theory of the specific Heat of Elastic Fluids; — 5th. On the quantity of Heat evolved by Combustion; — 6th. On the natural Zero of Temperature; — 7th. On the Motion and Communication of Heat, arising from Inequality of Temperature; — 8th. On the Temperature of the Atmosphere; and 9th. On the Phenomena of the Congelation of Water. The second chapter is on the Constitution of Bodies; it is subdivided into four Sections: — 1st. On the Constitution of pure Elastic Fluids; — 2d. On the Constitution of mixed Elastic Fluids; — 3d. On the Constitution of Liquids, and the mechanical relations betwixt Liquids and Elastic Fluids; and 4th. On the Constitution of Solids. The third chapter is on Chemical Synthesis; and tends to place the whole science of Chemistry upon a new, and more simple, basis than it has been upon heretofore. Besides the new views of subjects contained in this work, there will be found a great number of original facts and experiments.

Those who are desirous to be early supplied with one or more copies of Part I. will please to notify the same to the Author.

10, GEORGE-STREET.

S. RUSSELL, PRINTER, MANCHESTER.

PLATE I.

Dalton's 'Prospectus' to Vol. I, Part I of his *New System of Chemical Philosophy*, 1808.

Reproduced from an original copy in the possession of Roy G. Neville, Ph.D.

research[4]. Evidently Bostock, who was well known to Dalton, replied immediately indicating that he wished to receive four copies of the new book for, ten days later, Dalton sent another and longer letter with the books giving his views on the new work. By a very happy circumstance this rare prospectus and the two letters of Dalton were recently discovered among the Bostock family papers and have now passed into the possession of the present writer[5]. It is the purpose of this short article to give the complete text of these interesting and hitherto unpublished letters and the fugitive prospectus. The letters reveal the great modesty of Dalton and throw new light on his opinion of his work immediately prior to the acclaim it received almost universally when it later became known and understood. Through the medium of these letters we are allowed to catch a glimpse, as it were, of the author and his thoughts on the eve of publication of his *opus majus*.

The prospectus is printed as a broadside on paper measuring 203·2 × 251·5 mm, watermarked 1807. [See Plate I].

The accompanying first letter of Dalton to Bostock follows:

Manchester, June 11th, 1808.

Respected Friend,

Knowing that you are fond of chemical science & a fellow labourer in the cultivation of it, I have presumed to throw this in your way. Several of my friends here have been anxious to obtain a copy of the work as early as possible; & as it may be the case with some of those at a distance, I should feel a peculiar pleasure in affording such any facility in my power. I have sent herewith more than a dozen copies of the within to different Gentlemen in Liverpool who may be presumed to feel a greater or less interest in the subject, desiring such as are disposed to obtain a copy early to give in their names to you before the 18.th inst., & I shall consider it a particular favour if you would be so good as to transmit the same to me, upon the receipt of which the books shall be sent.

I am your's truly

J. Dalton

[4] Biographical information on John Bostock may be found in the *Dictionary of National Biography*, New York, 1886, **5**, 422 (article by Norman Moore); also in T. J. Pettigrew, *Biographical Memoirs of the most celebrated Physicians, Surgeons, Etc.*, London, 1839, pp. 1–20 (section 4), with an engraved portrait of Bostock.

[5] These documents had been among the Bostock family papers since they were received from Dalton. They were purchased from a Mr. John Bostock, a grandson of Dr. Bostock, by a London dealer and then passed into my possession. Enquiry has revealed that the prospectus is not present in any of the following major libraries: British Museum; Wellcome Historical Medical Library; Science Museum; The Chemical Society; The Royal Society; Royal Institution; Bodleian; Manchester Literary and Philosophical Society; Edinburgh University; Glasgow University; Bibliotheque Nationale; Harvard University; University of Pennsylvania (Edgar Fahs Smith Collection); University of Wisconsin (Duveen-Thordarson Collection).

Upon receiving a reply from Bostock, Dalton wrote to him again as follows:

Manchester, June 21—1808.

Respected Friend,

I rec^{d}. your favour duly & feel myself much obliged by your condescension & that of your brothers. Herewith I have sent 4 copies of my Chemistry which are the only ones that have yet found their way to Liverpool. It is now so long since I was there that I should be afraid of being lost almost; I do not know what this summer may produce, but one of the strongest temptations would be to have a little conversation with you on chemical subjects.

You have lately published on Respiration; is it not intended to hope a second part? About 2 years ago I attended Dr. Roget's Lectures on Physiology in which he gave us La Grange's theory, which did not meet my ideas; I made a great number of experiments & wrote an essay on the subject, which was read at our society, but which has unaccountably been lost or mislaid, so that I have not been able to find it for more than a year. The facts I have by me still. It appeared to me, rather more oxygen was spent than the carbonic acid required, but of this I could not be quite satisfied; however I was fully persuaded that the vapour exhaled has not its only source from the oxygen inspired. It did not appear to me that oxygen enters the blood, but rather that charcoal escapes by means of the oxygen, which gives the florid hue. My ideas on the subject agree pretty much with those of Ellis, whose essay on Vegetation I rec^{d}. last spring at Edinburgh, & with whom & Mr. Murray I had a good deal of conversation on the subject.

I hope you will not be altogether disappointed in my book; you will find several things in it that have not been published before; when you see how happily the atomic system, in the sequel, will accomodate itself to the neutral salts, the oxides, &c. I think you can hardly withhold your assent:—If I should not have the pleasure of seeing you at Liverpool in a month or two, I should be glad on some occasion to have your opinion on the various topics of my Book.

I remain yours assuredly

J. Dalton

The second paragraph of this letter is interesting as it gives an insight into Dalton's earlier views on respiration. His comments regarding the uptake of oxygen by the blood are erroneous, as is shown by the following quotation of John Murray[6] which is based upon the work of Allen and Pepys[7]. Murray states: "Many experiments have been made to determine the relation between the consumption of oxygen by respiration, and the formation of carbonic acid, and the extent of these changes. These have presented very discordant results,

[6] John Murray, *Elements of Chemistry*, Edinburgh, 1810, pp. 447–448.
[7] William Allen and William H. Pepys, *Phil. Trans.*, 1809, p. 404.

particularly with regard to the proportion of oxygen consumed to that of carbonic acid formed. By the late accurate experiments of Allen and Pepys it appears to be established, that there is no excess of oxygen consumed above that which is necessary to the formation of the quantity of carbonic acid gas which is produced, as had been supposed, but the one is equivalent to the other".

The last paragraph of this letter shows the humility and caution which were characteristic of Dalton. Moreover, it reveals that Dalton, although himself convinced of the truth of the atomic theory (as *he* interpreted it), nevertheless anticipated opposition to his views and scepticism from certain quarters of the chemical world[8].

[8] For safekeeping, the letters and prospectus were recently bound in two volumes by Sangorski and Sutcliffe, London, and now reside near an immaculate copy of the *New System* in the author's library and collection of early chemistry books.

REVIEWS

Goethe The Alchemist: A Study of Alchemical Symbolism in Goethe's Literary and Scientific Works. By RONALD D. GRAY. Pp. x + 312, with 3 Plates. Cambridge University Press, 1952. Price 42s.

LET it be said at once: this fascinating and erudite book is one of the best introductions to the mind of Goethe in any language. The question that arises immediately, however, is this: was Goethe an alchemist? A careful study of his works gives the impression that his early interest in the subject was a passing phase that might have given him a pattern within which he was able to work out his literary and scientific ideas. If the philosophical basis of alchemy is the "mystery of the conjunction of opposites", as Dr. Jung probably rightly surmises, then Goethe, who was obsessed with this mystery all his life, would have found a system of thought ready made, as it were, that solved this mystery in a very satisfactory manner—at least from his own symbological view-point. But just as many modern French poets are using alchemical symbols to express their advanced ideas of poetry, so Goethe, who was first and foremost a poet and only secondly a scientist, used alchemical symbolism again and again in his poetry, often in a veiled form and almost crudely, as he did in his "Faust".

We have this philosophy of the union of opposites as the basis of Chinese Taoism; it is the philosophy of the Tantras and of Mahayana Buddhism, of Yoga, and can be found in a highly sublimated form in certain Christian theological works: but Goethe happened upon alchemy, and it is the symbols of alchemy, therefore, that became the tools for his poetry and, later, for his scientific theories. And these theories, for all their profundity, were not those of modern times; they were philosophical and ontological ideas applied to the phenomena of nature, and they were, in a sense, the culmination of a tradition that began in the Middle Ages, flowered during the Renaissance, was systematized by men such as Paracelsus and Boehme, and, most important of all, they became the dominant passion of the élite of the 18th century. This must never be forgotten, despite Lavoisier, Priestley, and all those who were the precursors of modern science. For them science was science, in the sense that science is science for the physicists of today, whatever their ultimate and secret aims may be; but for Goethe and the philosophical seekers of the 18th century, their concept of "science" was a religious quest, an attempt to discover the truth of the origin of natural phenomena and thereby at the same time to acquire an awareness of consciousness that would bring the seeker near to God. After all, that is what 18th century alchemy professed to give to the adept, to the seeker of the Holy Grail—the symbolical *Lapis*—a true knowledge of God; and as the Church had supposedly failed him in that century, various pansophic paths were open to him, of which alchemy, having become part of the esoteric masonry of the 18th century, was one of the most dignified and most interesting. Goethe, a member of occult societies, a member of the Order of the Illuminati and a professed mason, all his life followed the pansophic path. "Pansophism" was the basis of all his ideas and actions. In this sense he can be said to have been an alchemist: he followed the alchemical way of life which allowed his genius a full flowering, and which would have been impossible a century later.

This alchemical way of life runs like a highly coloured thread through the fabric of European civilization; it was the philosophically scientific approach to problems, and content with a subjective proof, as opposed to modern science which demands an objective physical proof of its experiments. Many pages of Goethe read like extracts from Proclus and the latest Neo-Platonists; Proclus, with his high regard for Chaldean magic, reminds us of Goethe with his pansophic beliefs, with his "Dämon", which must be taken more seriously than the average professor of literature will allow—beliefs all purely subjective, not necessarily wrong, of course, but depending on a passionate conviction of the truth of one's own ideas. Witness Goethe's fanatical belief in the "Urpflanze"; the conception of the "Urpflanze" derives, no doubt, from Goethe's reservoir of alchemical ideas, but it is not a direct outcome of these ideas as Mr. Gray suggests. The "Urpflanze" is a part of Goethe's pansophic philosophy of nature. Goethe's idea of the Hermetic Art was that of a means—the best available means—to the redemption of man, based upon the analogy of the mystery of the union of opposites. The "Urpflanze", his theories of colours, his many other experiments, are all the different facets of one idea: that nature is a pouring out of God's creative powers, therefore "nature" is in itself something divine—which leads to the old alchemical maxim that the "superior awareness of nature is the perception of God".

The Philosophers' Stone is a symbolic proof of the supreme unity of nature; in the same way Goethe held that the "os intermaxillare" was the last link in the chain of proof of the unity of all nature. He explained this to Herder with reference to the Bible; his subjective certainty of this supposed fact was so great as to attain an equality with his conception of religious truth. The alchemists were deeply religious people, and, from this point of view, Goethe can be said to have shared their views that all natural phenomena was divine.

Before Goethe went to Italy he had a dream; he knew it was a dream of good fortune. He was in a boat, going over to an island on which could be found the most beautiful pheasants. The natives loaded the boat with these pheasants. "The birds were indeed pheasants", says Goethe, "but as in dreams everything tends to be transformed, they appeared to have long tail-feathers spangled with coloured eyes like peacocks or rare birds of paradise". Mr. Gray interprets this dream as a symbol of future glory; moreover, in the language of the alchemists, the Peacock's Tail is the name given to the scale of colours that appear in the vessel before the crystallization of the Stone. Can this dream mean that Goethe, on a higher level, sought all his life the Philosophers' Stone, not perhaps the Stone itself, but the powers that it was supposed to confer? Just as the "os intermaxillare" can be equated with the Stone in Goethe's imagination, so Mr. Gray mentions many other incidents in Goethe's life that can be interpreted as having alchemical significance. Was Goethe himself always conscious of this "alchemical symbolism" that gave especial meaning to the facts of his life? Many lives of other men can be interpreted "alchemically" by using the symbols much in favour with modern schools of psycho-analysis. What, however, differentiates Goethe is the fact that his whole life was concentrated on the problem of his own redemption, and here he was a true disciple of the pansophist ideas of the 18th century. We cannot narrow down this fundamental stream of Goethe's life into the confined channel of alchemy; Goethe was a pansophist,

and as alchemy, as well as the Cabbala, magic, and the Pythagorean number system, were part and parcel of the pansophist way to illumination, Goethe can be regarded in this aspect as having been an alchemist. We must not apply modern points of view to the alchemy of the former centuries; the pansophists were hardly interested in what we call chemistry, nor were they interested in "exact science": if they were, it was only in so far as chemistry, for instance, might be useful for their alchemical experiments in the early stages of the "Great Work". Goethe belonged to the Order of the "Illuminati", the members of which were neither interested in pure philosophy nor in a social ideology. They had received an "illumination de l'esprit" and therefore they claimed to have been the recipients of super-rational, transcendental knowledge. As has been said, alchemy was only one of the means to this knowledge; Faust practised magic as the certain road to the success he desired. The episode of the homunculus is of secondary importance. This super-rational awareness, the "intuitio intellectualis" of the scholastics, the "prajña" of Buddhism, the "vidyâ" of Hinduism, these are all terms that point to the "inner awakening", to the illuminating super-normal awareness, which, when attained, placed the Philosophers' Stone in its proper place; that is, according to the secret teachings of the esoteric societies of the 18th century, it was necessary at least to know how to attempt to prepare the Stone, but the absolute fulfilment of this operation was not insisted upon, because when the neophyte became a "master" or an "adept", that is, when he had become "illuminated" he had, *ipso facto*, undergone in a personal sense the process of transformation, of having been transmuted into one who had attained the higher consciousness.

What the reading of alchemical books did for Goethe in early life was to turn him to the philosophy of Spinoza—at least to that part of it that sees all substances as infused with spirit. This is mentioned in "Dichtung und Wahrheit", where alchemy is described as one way only of attempting to explain the super-rational mysteries of the cosmos. And, after that, alchemy is no longer important in Goethe's life except, to use modern phraseology, as a powerfully functioning subconscious pattern which conditioned profoundly the long life of Goethe, the Illuminatus,

What has been said here should in no way detract from the excellence of Mr. Gray's book. It is also a most admirable introduction to the pansophic ideas, as seen through the mind of Goethe, of two centuries ago. This pansophic structure of ideas must be studied, if the later phase of European alchemy is to be understood. What is so interesting in this book is the infusion, as it were, of these ideas into the workings of the minds of the outstanding personalities of the time. They built up extraordinary subjective worlds, a logical synthesis of ideas that professed to give guidance to those who asked for it. The great advantage of this cosmology, for that was what Pansophism claimed to be, over modern attempts to explain cosmic mysteries, is that the moderns relegate the solution of the great problems to the lower depths; they have made the "Subconscious" a receptacle for all unsolved problems, and have even put the "First Cause" into it. Alchemy has always been an upward path; by means of a technique of exteriorization it has attempted to solve the problem of man and the universe by always insisting on the divine nature of the First Cause. In the present work, the author stresses the important facts that should be known if one is to get any meaning out of the alchemical texts; and that is why,

in a narrower sense, this book is, in addition, a most scholarly introduction to the world of alchemy itself.

The very complete bibliography is recommended to the reader. There are two omissions: the brochure by Maack, "Aurea Catena Homeri" should be included in Part 3; also the very important contribution by Professor Kerényi on the myth in Faust II—mentioned in the preface to Professor Jung's *Mysterium Coniunctionis*. G. H.

Der Stein der Weisen. Wesen und Bildwelt der Alchemie. By G. F. HARTLAUB. Pp. 52. 4 coloured and 55 photographic plates, together with many reproductions of engravings. Munich: Prestel Verlag. 1959. English price 15s. 3d.

SELDOM does a modern study of alchemy afford artistic delight in addition to scholarly content, though Professor Read's *Prelude to Chemistry* and *The Alchemist in Life, Literature and Art* are noteworthy exceptions to this observation. Within the limits of its sub-title the present work may be fairly described as the most attractive portrayal of the pictorial art associated with alchemy to appear since the war. That this should be so is not surprising, for the author, less well-known in this country than on the continent, is an expert in his field; readers may remember, for example, an earlier article, "Alchemisten und Rosenkreutzer", which appeared in *Der Kunstspiegel* (1947).

The first dozen pages are devoted to a series of vignettes serving as testimonies to the rules of alchemy and as prerequisites for an adept. Most of these are already well-known and consist of quotations which range from the works of Zosimos to the "Alchemica Rosa" of Yeats. That Martin Luther should have expressed views on alchemy may come as a surprise to many, but his understanding and appreciation of the aims of the art are duly recorded here.

A brief discussion of present views on alchemy, including Jung's psychological conception, is followed by a consideration of the art forms in which aspects of alchemy have been expressed, including symbolism. The next four pages show the alchemist as a subject for genre painting, after which the descriptive section of the book closes with accounts of transmutations accredited to Flamel, Trevisan and Trismosin, adapted from those recorded in Schmieder's *History of Alchemy*.

The most interesting section is undoubtedly the collection of 55 photographic reproductions at the end. The illustrations are arranged in chronological order of origin, from the 15th century British Museum MS. portrayal of Thomas Norton in his laboratory up to an early 18th century copper-plate engraving of the goldmaker Cajetan. Apart from the better-known paintings of Dürer, Breughel the elder, Teniers the younger, Stradanus, van Ostade and Wijk, there are representations of apparatus and of medallions struck to commemorate successful transmutations; while the examples of "allegorical" scenes, culled from various continental codices, are equalled only by the selection in Jung's *Psychologie und Alchemie*.

It is to be hoped that Herr Hartlaub will continue to enrich our knowledge of pictorial aspects of alchemy with further books like this one which, in its most attractive binding and format, represents remarkable value for the price. H. J. S.

Les Alchimistes. By M. Caron and S. Hutin. Pp. 187. Many reproductions of photographs and engravings. Index and Bibliography. Paris: Éditions du Seuil (Coll. Microcosme, "Le Temps Qui Court," No. 16), 1959. Price 450 francs.

Like most recent French expositions of alchemy this attractive little book demands of the reader a sympathy with the subjective traditional view. "Without disregard for its true bearing upon research and its practical aims", declare the authors, "alchemy must be regarded as being essentially a method of 'spiritual realization' ". Nevertheless, the same broadminded approach is found here as in Dr. Hutin's other works, notably *L'Alchimie* and *Les Gnostiques*; due weight is given to both esoteric and exoteric aspects of the art.

In the early part of the book we are presented with a cavalcade of well-known figures, ranging from adepts such as Arnold of Villanova, the pseudo-Lull, Nicholas Flamel, and a host of others, up to charlatans whose connexion with alchemy was exceedingly tenuous—the Parisian César, "un homme fort habile, qui se targuait de pouvoir faire apparaître des démons cornus", and the later "Comte" de Cagliostro. Less familiar to English readers are the "hyper-chemists" of the 19th century—Tiffereau and Jollivet-Castelot, who sought to effect a true chemical transmutation based upon the "laws of universal transformation". The happy results of Tiffereau's experiments under the auspicious influence of the Mexican sun could not, alas, be repeated for the benefit of the Académie des Sciences!

A survey of laboratories and equipment, followed by short histories of the development of alchemy in China, India, Alexandria, the Muslim world and Western Europe adds little to what has been published already in this country. Of far greater interest is the latter half of the book, consisting of a detailed description and discussion of the *magnum opus* in both its practical and symbolic aspects. A greater recourse to the texts is found here than in *L'Alchimie*.

The esoteric side of alchemy is, of course, the prime concern of French writers on the subject. Considering the conception of alchemy which prevailed in France from the late 18th century to the end of the 19th as a result of the confused utterances of the many *illuminés* who arose in the wake of the Martinists—the Abbé Constant, Stanislas de Guaita, etc.—it is highly noteworthy that a number of scholarly interpreters should have followed the pseudonymous Fulcanelli (Vulcan-Helios?). Inspired by Eugène Canseliet, René Alleau and Claude d'Ygé, to name but two, have shown a profound insight into the Hermetic art.

The assimilation of a wide range of symbolism to a subjective, and hence somewhat speculative, art is inevitably simple; the assignment of origins calls for painstaking research and rational thought. In this respect it is surprising to find the legendary Kabeiroi and their reputed fire-theurgy seriously invoked in the search for the origins of practical alchemy, a thesis presumably borrowed from both Alleau and Eliade. A more certain origin may yet be discerned from the undeciphered records of Syria or Mesopotamia!

However, on the esoteric side this book shows clearly how, from a medieval type of gnosis which advanced a Hermetic interpretation of the dogmas of Christianity, alchemy developed into what Jung would term an unconscious or subliminal compensation of the prevailing Christian creed.

H. J. S.

De la Pierre Philosophale à L'Atome. By RENÉ MARCARD. Pp. 392, with 23 illustrations. Paris, Librairie Plon, 1959. Price 21s. 6d.

HERE we have a history of chemical science, beginning with the origins of alchemy, and containing a mass of interesting information and a great deal of material that will be new to English readers.

The bibliography is valuable; the Dictionnaire Hermétique, Paris, 1695, is not, however, by Manget. (See Ferguson I, 210.)

In the first part of the book the author gives us a history of alchemy, beginning with prehistoric man. We learn that he must have had a perfected technique for the cutting up of the skins of wild animals, and in preparing them for use. Pottery and metallurgy had also attained a certain level of perfection, and so we have here the dawn of the scientific age—but "science" in the "old sense", that is, in the alchemical sense. The author next describes the alchemical beginnings in China and India, the Phoenicians, and so on, until he reaches Alexandria, where we are given a lively picture of the great intellectual activity in that city.

The next two chapters, "L'Alchimie et les Alchimistes" and "Quelques Fils de la Doctrine", are among the best and most informative in the book. The theory of the Great Work is discussed and interesting excerpts are given from the best authors; also the great alchemists of the early Middle Ages are mentioned in detail, together with an exposition of their theories. There are chapters devoted to the "reformers"—Paracelsus, Libavius and others; to the "technicians" Agricola, Caesalpinus, Palissy; and then the author gives us summaries of the works of Leonardo, Cardanus, Porta, whose ideas, however, do not greatly influence the chemical scientists of the 16th century, such as Vigénère, Zachaire, Guibert and others, still immersed in the old Hermetic—and in this 16th century also, the Cabalistic—traditions. It is not until the 17th century that the "révolution chimique" has begun, with van Helmont, Jean Rey, Boyle, Glauber, Stahl, and other well-known names of this epoch; and here the author again gives us much interesting information, often personal details, of the lesser personages such as the Spaniard Alonso Barba, the gifted pupil of Perez de Vargas and Villa-Feina, the famous specialists of the silver mines of Peru.

The remainder of the book is devoted to the gradual emergence of the modern science of chemistry, and special attention is given to Cavendish, Priestley, and Lavoisier; in fact, the author gives us a very well-written and concise history of the subject. The last chapter is entitled "L'Alchimie Moderne, de la Fiction à la Fission". The author ends his book with these words: "Un univers terrestre venait de finir, un nouveau monde recommençait. Mais tout cela n'était qu'un songe. Plus exactement un affreux cauchemar".

G. H.

PUBLICATIONS RECEIVED

Revue d'Histoire des Sciences et de leurs Applications. Tome XII, No. 3, July-September, 1959. Paris: Presses Universitaires de France. (Annual Subscription to Great Britain and the Commonwealth, 24s.)

This number includes articles by F. Russo—La constitution de l'algèbre au xvi^{e} siècle. Étude de la structure d'une évolution; Louis Dulieu—Les Magnol; Giorgio Tonelli—La nécessité des lois de la nature au xviii^{e} siècle et chez Kant en 1762; René Taton—Condorcet et Sylvestre-François Lacroix.

Schmieder, K. C. "Geschichte der Alchemie" (Halle, 1832), rpd. Ulm, 1959. Price £4 4s.

Hoeppli, R. "Parasites and Parasitic Infections in Early Medicine and Science". Singapore, University of Malaya Press, 1959. Price M$25.00.